THE BOOK OF *REST*

THE ODD PSYCHOLOGY OF DOING

NOTHING

A. J. MARR

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"Art Marr's amusing and thoughtful analyses of psychology have long delighted readers of his books and blogs. Now his 'The Book of Rest' gives an engaging antidote to perseverative thought and stress. Marr is always a good read."

Dr. Kent Berridge, James Olds Distinguished University Professor of Psychology and Neuroscience at the University of Michigan

Links to my 16 books from psychology to satire on pp. 126-129

Preface

How to Rest Deeply, *Or, why you don't need to read this book*

Think of your meaningful tasks at hand (i.e., events that have branching virtual positive outcomes), choose any meaningful task and consistently for an hour or so alternate its performance with thinking non-judgmentally or 'in the moment', or being mindful. Because you do not have to make continuous judgments between rational (meaningful) and affective choices which are derived from the present (distraction), past (regret), or future (worry) your muscles will soon be at an inactive or resting state, and their prolonged inactivity will result in the release of opioids or 'endorphins' in the brain that will give you a feeling of pleasure. In addition, the anticipation or awareness of subsequent meaningful choices during mindfulness sessions and the performance of those choices afterwards increases attentive arousal (due to the activity of midbrain dopamine systems that cause arousal but not pleasure) that accentuates the feeling of pleasure in relaxation (or dopamine-opioid interactions), resulting in an enhanced positive emotional state during and after mindfulness sessions, or a sustained feeling of 'bliss'. You will note that you will feel totally relaxed and have greater self-control and an accompanying sense of positive arousal, pleasure, and alertness, thus representing good feelings and much higher productive capacities that will extend into your otherwise stress filled day. And the good thing is that you will be fully rested and alert and experience a natural 'high' and will not have to take a course on mindfulness, or

meditation, or even for that matter read the book that follows! It's that simple.

So, what's different about this procedure?

It's meditation, defined not as a unique state but as merely a relaxation protocol, but with the crucial added element of alternative non-discursive thought or 'meaning'. Meditation, from focal meditation to mindfulness, entails the avoidance of all conscious discursive or unpredictable transitive (act-outcome) or 'what if' decision making or judgment that represents past, present and future judgments that can easily transition into perseverative thought (i.e. regret, distraction, and worry). In other words, meditation is reducing discursive thinking by being in the moment or 'mindful'. The avoidance of discursive thinking or 'mind wandering' prevents the development of future perseverative conflicts and results in the covert musculature becoming inactive, or a pleasurable state of rest. Relaxation is achieved by avoiding discursive judgment rather than all judgment, while anticipated and subsequent non-discursive or meaningful behavior *sustains and enhances* the positive affect due to relaxation both during and after meditation sessions. Thus meditation, to be effective or most 'affective', must represent a *dual* cognitive strategy that couples the inhibition of discursive thinking with subsequent non-discursive or meaningful judgment or thought.

If the procedure works, then reading the explanation that follows is superfluous. If it doesn't work, the explanation is wrong. Either way is reason enough for you not to read the book. But you can go ahead anyway if you are curious, or just skip to the procedural and explanatory postscript on pp. 64-77.

Introduction

Relax!

It's easier than you think!

A state of rest or relaxation is the one emotional state (and it *is* an emotion by the way) that we want to accompany us always. It is a source of energy, resilience, happiness, and pleasure. There are a million ways to relax, or so it seems, but there is no one explanation of what relaxation is, how it works, and what makes the muscles tense, or relax. In its simplest guise, it's merely a state of inactivity, in effect the act or non-act as it were of doing nothing. But what is doing nothing? What is its psychology, its philosophy, its *explanation*?

You see, without a suitable explanation, you will never learn how to relax or be motivated to be relaxed because your methods will be ill informed, uncertainly justified, confused, time-consuming, and for the most part, ineffective. Proceeding from explanation, you can learn how to be relaxed, why it is important, do it simply and easily, and in the bargain, know whether your explanation is up to snuff, or not.

That indeed is what good explanations do. They provide the means to test them, the procedures that vindicate them, and self-destruct or morph into better explanations if they don't. If they work they provide a window to the world, and if they don't, then it pays for the people like me who propose them not to quit their day job. Good explanations also act to compress a world of facts within a phrase, and from the

seed of a simple idea see emerge a universe of possibilities. From Pasteur's theory of disease to Darwin's principle of natural selection to Einstein's $E=MC^2$, good explanations are simple, easy to understand, and above all make firm and bountiful predictions that are easy to test.

So, following this hallowed tradition, I will propose a simple explanation of relaxation and its antithesis of stress that is entirely new and contrarian to the common view that posits them as an artifact of a certain prehistoric relationship with lions, and tigers, and bears. I will also break with scientific tradition by presenting my argument in backwards order, which is from the procedure to the explanation rather than the opposite. This is after all a self-help book first. So, we will get on with the self-help part, and with its practical success, hopefully the reader will have some interest into *why*.

Chapter 1

A Get Rest Quick Plan

Here is the fool proof method to being relaxed, staying relaxed, anywhere and anytime. No seven-day seminar, doctor's appointment, or heavy lifting is required, and you can even skip the rest of this book. It consists of three words. Read it slow so that it can sink in. The explanation that follows is easy too, and it is hoped, self-evident.

Avoid Cognitive Perseveration

That's it. Sounds great, and it seems simple too. Let's get started, you say. One thing though.

What the heck is cognitive perseveration?

Cognitive perseveration is what you tend to ***not*** do when you are walking on the beach, are at home sitting on an easy chair looking at your garden, or are otherwise unbothered by the worries, cares, and distractions of the world. In these occasions, relaxation is the order of the day. That's because cognitive perseveration ***is*** the worries, cares and distractions of the world, and that's what's causing you to be tense or 'stressed'. Cognitive perseveration is consciously (e.g. worry, rumination) or non-consciously (e.g. apprehension, distraction) dwelling on decisions, problems, or dilemmas that have no positive resolution. To avoid these cognitive events, the common solution is to physically remove ourselves to a secluded spot, but is this necessary? After all, perseverative thoughts are merely cognitive behavior, and you can pretty much avoid them at will, or can you?

You can, if you have the proper justification, born of explanation. But first, let's define what we mean by worry, care, and distraction. It all has to do with indecision, dealing with dilemmas, or more specifically, our inability to make a decision in foresight or hindsight when we know we must. Can't figure out God's opinion of you or comprehend your income taxes? Relax, you can just postpone it for another time. However, if you are near death or tax time, death and taxes take a whole new meaning, and you need to make some good decisions now.

Cognitive dilemmas that reflect continuously considering past, present, and future events are respectively called rumination, distraction, and worry. These dilemmas have no satisfactory issue, and likely never will, but we keep at

them until we are tense and miserable. To illustrate, let us conduct a simple mind experiment, which is way of translating the hypothetical into the obvious.

On your way to work, you accidentally back over your cat, and he is on his way now to the animal hospital to recuperate. Naturally, you are upset about this and are somewhat tense too as your mind is set off in different ways, none of them good. So, you ruminate or mull over the decisions you could have made to avoid the accident, worry about your wife's reaction and how you will respond, and are distracted enough to call the hospital every few minutes to check on the health of your beloved tabby. These represent cognitive dilemmas that leave you no recourse. In this case, thinking about what decisions you could have made, will make, or will make now are fruitless, with taking any fork in the road leaving you as miserable as before.

The solution is simple, merely avoid or otherwise eliminate these perseverative thoughts *completely and consistently*, and you will be calm and relaxed.[1] However, it is a common aspect of our thought that despite knowing better, we often

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[1] **And very likely you will be happy too, since persistent relaxation (a relaxed state for a half hour or more) is an affective state because it increases the level of endogenous opioids centered in the midbrain, which are the cause of all our pleasures, and mitigates the palatability or reward value of other behaviors (food, alcohol) that increase opioid release. In this way, it inhibits otherwise harmful cravings. Perseverative cognition may also be the result of 'mind wandering', or spontaneous, undirected, or discursive thinking, which has as of recent been strongly correlated with a state of unhappiness. For more on this, look at the TED video by the psychologist Matt Killingsworth.**

feel we have no choice but to continue to worry, fret, and be distracted, if not constantly then often enough to disturb the inner calm which is the default state of being alive. In other words, the decision to continue to ruminate, worry, and be distracted is often signaled by the energizing, arousing, or 'affective' feelings that accompany the uncertain positive implications of perseverative thought.[2]

Ultimately, it is much easier to resist temptation by making sure that temptation is never encountered. Thinking of events in the future, no matter how innocently conceived or passively initiated, may easily lead to cognitive perseveration, and it is difficult to extricate ourselves from temptation once it presents itself. One solution is to primarily perceive life 'in the moment', or by being mindful, and to avoid or repress all act-outcome decision making or 'thinking' that can segue into worry, guilt, or distraction. This unfortunately is but a temporary solution, as boredom compels mindful or otherwise mediative practices to be brief. A more effective solution is not to eliminate all choice, but a subset of choice that allows us to remain considerate of the meaningful choices in our lives, while controlling or avoiding the small ones that are most characteristic of our daily stresses.

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[2] The prospect of uncertain and positive outcomes is often intrinsic to cognitive choices. As we will discuss in a later chapter, the perception or anticipation of uncertain positive outcomes induces the release of the neuromodulator dopamine that adds value to moment to moment behavior, but is felt as state of attentive arousal, and not pleasure. Hence despite the neuro-muscular pain induced by perseveration, conflicting choices may still induce positive affect and mitigate against their avoidance, even if we consciously recognize that those choices will likely have no positive issue.

Passive Perseveration

When we think of cognitive perseveration, we think of the worries and concerns that are the emotional signposts that signal branches in our personal passages of life that are difficult if not impossible to logically decide between. But on the way to any fork in the road we are beset by countless other decisions which represent the smaller dilemmas of plodding forwards or taking a moment to smell the flowers. The former choices representing major decisions we often dread, but the latter are trivial, and are something not to avoid, and certainly not dread. And it is here that we are wrong.

But what are the actual entailments of perseveration? *Active perseveration* comprises the intermittent worries, difficult decisions, and regrets that consist of our conscious perception of our world, whereas *passive perseveration* represents the nonconscious minor distractions and concerns, generally slight but consistent, that populates our days. When we actively perseverate, our thoughts and decisions are focused on the dilemmas, from past, present, to future, that decide our fates, whereas passive perseveration are the scarcely considered minor choices we make between minor or trivial affective and rational choices that cannot be logically compared. Thus we may worry about decisions that can impact our finances, relationships, or our life itself, from investment decisions, relationship choices, or elective medical procedures. On the other hand the continuous momentary decisions we make between pursuing rational (e.g. doing productive work) versus affective goals (e.g. checking social media) we attend to non-consciously and with little concern, and end up the day far more stressed and exhausted.

For active perseveration, the pain of anxiety can cut deep, but the emotional injury is nonetheless intermittent, and we can recover emotionally from the pain of making a difficult choice. On the other hand, for passive perseveration, although tension is slight, it is continuous, and its uninterrupted presence is like a death by a thousand cuts, where each incision causes us to emotionally bleed out into exhaustion and pain.

Perseveration is most commonly caused by mundane and trivial conflicts, not exceptional and major ones. If we were to look at the main cause of our stresses from day to day, what populates our daily experience are minor dilemmas or distractions. Distractions are the minor positive affective states that are elicited by the possibility of engaging in a novel event of little or no meaning that take us briefly away from behavior of more significance. The slight arousal that occurs at the prospect of looking at our email, social media, of simply chatting with a co-worker is defined as 'priming'. In layman's terms, priming is called 'temptation', the affective impulse that tilts the scales and makes a choice more important or salient that it rationally is. It is this conflict between rational and affective choices that induces slight but consistent activation of the covert musculature that cannot be placed into a value hierarchy or order.

Avoiding distraction is not easy to do, particularly if the alternative is a singular course of action that may not in the moment possess enough significance or meaning for us to resist, as when our only alternative choice is a dull work assignment that is far from its deadline. On the other hand, if we have the option of performing an array of alternative meaningful tasks, then we can more easily resist positively affective yet meaningless tasks for meaningful alternatives

that easy to sort out and rarely conflict. It is that solution that we will propose in Chapter 7.

Ultimately, our behavior is a result of justification, derived from affective and effective rationales, of emotion and reason. As we shall see, faulty justifications come from faulty explanations. Fix the explanation and the motivation to change becomes real because we now know how our stresses work. Knowing yourself is the essence of philosophy, and to be able to rest, we must be philosophers as well.[3]

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[3] **Our explanation of perseverative cognition generally conforms with the 'perseverative cognition hypothesis', that holds that cognitive perseveration is the main constituent of stress. However, this hypothesis does not provide an *explanation* of how cognitive perseveration signals tension and stress, nor does it describe the neurological correlates of neuromuscular tension and its opposite of rest. Because it is bereft of explanation, it cannot be used to explain corollary states of rest, meditation, peak experiences, and the like which we derive directly from the explanatory models to follow in this book.**

Per Wikipedia, the 'perseverative cognition hypothesis' holds that stressful events cannot affect people's health, unless they think repetitively or continuously (that is, 'perseverate cognitively') about these stressful events. Stressful events themselves are often too short, as are the physiological responses to them. Therefore, the physiological responses during these stressors are unlikely to cause bodily harm. More importantly, many stressful events are merely worried about, or feared in the future, while they often do not happen or do not have the feared consequences. Nevertheless, the body reacts with prolonged physiological responses to continuous thoughts (perseverative cognition) about these stressors. Therefore, it is the perseverative cognition, and not the stressors that can eventually lead to

Chapter 2

Rest Explained

Rest is simple to explain, it's nothing really, or to be exact, doing nothing. Rest is a matter of generalized covert muscular inactivity, and its benefits are manifest. To be rested or relaxed means to refrain from perseverative thought, which means that without worry, rumination, and constant distraction, you are less likely to be frustrated, depressed, or angry. Working in a rested state leads you to be more productive, focused, and less easily tired. Rest also feels good or is pleasurable because muscular relaxation is accompanied by the continuous release of 'endogenous opioids' in the brain.[4] These naturally occurring brain

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disease. In scientific terms, it is said that perseverative cognition is a mediator of the detrimental effects of stress on one's health. Since its publication scientific evidence for this hypothesis has been accumulating.

[4] And if you concur with the Epicurean belief that a state of happiness is equivalent to a state of continuous pleasure, then the continuous opioid release in relaxation is just your ticket. Opioids are the source of all of our pleasures, from eating a ham sandwich and smelling a rose to having sex, but whereas our common pleasures end with satiety, the opioid induced pleasures of relaxation can continue without end as long as we stay relaxed. Although opioid inducing drugs are addictive, it must be noted that the positive affective states associated with other psycho-active substances or behaviors,

chemicals help reduce blood pressure, indirectly strengthen the immune system, reduce our sensitivity to pain, reduce addictive cravings for other substances that increase opioid levels (food and alcohol), and makes your brain work better. Opioid release in relaxation or 'somatic rest' as well as for all of our pleasures is also *labile*, and can increase or decrease due to its cognitive context, the neuropsychology of which we will explain in greater detail later in this book. Good stuff indeed. So why don't we feel rested all the time? The short answer is because we can't make up our mind, and our musculature is called upon to help us do so, but in a quite unexpected way. The cost is the loss of all the benefits of relaxation, for the prospective gains that as will be demonstrated, are often utter mirages.

So, that brings us to explaining the converse of relaxation, or muscular tension. Our muscles move when we walk and talk and grasp things, and they also tense and are primed to move when we are about to engage in a strenuous activity,

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whether it be for addictive drugs (heroin, cocaine) or video games or the 'pleasures' of esteem, power, of affiliation activate not opioid but *dopamine* systems in the brain that instigate action, not sustain repose. This state of 'wanting', although positive, is not pleasure, any more than an itch that demands to be scratched. Sounds confusing? It needn't be, and for more information that can sort this all out for you, I refer you to this article by the neuropsychologist Kent Berridge, whose work firmly established that our pleasures, or what we like and want, are not quite what we think they are. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2756052/

from running a marathon to running away from a predator. For these voluntary muscles, they continue being activated when they tire, and when they start to hurt we stop. Whether running, talking, grasping, or lifting, we have a conscious control over these aptly named 'voluntary' muscles, and cease their activity before we approach total exhaustion. However, there is another class of muscles which hold us up. These muscles are moving all the time, and often for reasons so slight that they are barely if at all perceived. These are our postural muscles. When they activate we scarcely perceive it, and only when they remain activated do we remark upon it, as they leave us literally exhausted and in pain. These are our 'involuntary' muscles that act reflexively and non-consciously, for the most part that is, and how and why they work is the pivotal concern of this book.

To illustrate, take a relaxing drive to the beach, say the destination is a three-hour drive away. You walk on the beach, you swim, and when you come back you are exhausted. So why are you so tired? That's because your postural muscles are continually activated, adjusting your torso to every twist and turn, bump and dip in the road. All that muscular adjustment is pretty darn tiring, and your relaxing trip ends up anything but.

But there are also non-physical or 'mental' reasons that lead to the sustained activation of these muscles. These reasons are generally non-conscious in nature yet cannot be easily explained or 'verbalized'. Now, acting non-consciously is no mystery to us, as we can always explain it in retrospect. Drive your car to work in the morning, and your conscious attention can be directed to the radio, a phone call, or day dreaming, and yet non-consciously you are making continuous and rational decisions to speed up, slow down,

make turns, and keep on course to your destination. Your muscles move to steer the car because of rational opportunities that are taken moment by moment to get you places in the safest and quickest way, and you can easily rationalize or understand them after the fact.

But what happens if opportunities conflict, with no satisfactory recourse of choosing one over the other, and much to lose if one route is chosen over the other? Dallying over such dilemmas is not a productive thing, and to force you to make your decision quickly or else retreat from the dilemma altogether, your body sends you another non-conscious message. Namely, your postural muscles contract, soon tire, and the resulting discomfort forces you to attend to the problem and make a decision, or else escape the situation. This brings us to the pivotal concept of this book that is at the core of our procedures and explanation.

Voluntary muscles move because of opportunities, and involuntary muscles move because of dilemmas.

In the tale of Buridan's Ass, an ass is faced with the dilemma of being equidistant from a bale of hay and a bucket of water. Not being able to decide whether to eat or quench its thirst, the ass simply starved to death as it pondered the unresolvable. As humans who daily encounter far more dilemmas than an ass could possibly perceive, it is equally understandable that we would hesitate, and in the aggregate, lose our days rather than lose our lives. Of course, we would not starve ourselves to death for any one choice, but add up all those micro-costs for those countless albeit small dilemmas we face daily, and we might as well starve to death in face of a day's indecision.

Whereas nature abhors a vacuum, human nature abhors the vacuum of indecision. For the minor indecisions that

populate our working day, there is rarely a threatening event that would cause us to take flight or fight, and they certainly aren't demanding in the sense of a pending deadline at work. They are minor, trivial events, but they are persistent, and that is the key. They cannot be ignored, and they cannot be acted upon either, and since thinking is of little use in resolving them, your postural muscles contract to expedite your thinking for you, and force you to make a choice or avoid the situation. So why do postural muscles contract to begin with when you are posed with dilemmas? It is because they *hurt*. But what is the purpose of pain? Simple. Pain signals the problem and its obvious remedy, namely avoidance. Think about it. We don't put our hands on hot cooking pots, roaring fires, or hornet's nests because these things will hurt, and if we didn't have a sense of pain to warn us when we touch hot things, then instead of being able to make toast, we would *be* toast. Pain makes a faster case for action than deliberation, and our minds oblige our need to survive by forcing us to make a choice or avoid the situation. This avoidance can be physical or mental, as we can walk away from the situation or just avoid thinking about it. In general, you don't want to think about events that cause pain, and if pain makes your decision making speedier and more useful or else impels you to escape, it has survival value and is thus easily learned. [5]

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[5] As with nearly all theories that are purportedly worth their salt, our theory is not original, but was conceived by the psychologists Neal Miller and John Dollard in the 1950's. Their Dollard-Miller theory of anxiety hypothesized that tension and anxiety (or fear, which they broadly defined as a pain reaction to conditioned stimuli) were secondary or learnable 'drives' that occurred whenever one was faced with 'choice-choice'

So, for example, on April 1 we think about our taxes, feel tense when we see no good alternative to paying up, and because of the pain postpone our day of reckoning until April 14, when we have no other choice. In this case, tension is rewarded or 'reinforced' because it leads to a favorable outcome, namely escaping from a no-win scenario. However, many dilemmas are continuous with either option too important to ignore or avoid, and we possess faint hope of their resolution. That is often enough for us to dwell on such matters, even though the odds are long if not impossible. Sometimes these dilemmas represent future intractable issues, such as whether when traveling on vacation you worry, and are tense as you decide whether to turn back to see if you left the water on, and other times they

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conflicts, and to escape these continuous or perseverative conflicts, anxiety impelled faster avoidance behavior, and was reinforced. For example, *avoidance-avoidance* conflicts would represent a conflict between two choices we would rather avoid, such as visiting the dentist or living with an aching tooth. *Approach-approach* conflicts represent conflicts between two desirable options, such as conflicts between whether to access social media or stay focused on work. Finally, *approach-avoidance* conflicts represent conflicts between options that have good and bad qualities, such as whether to order dessert after dinner. To have dessert means to indulge in a tasty treat and consume a lot of calories, in contrast to the alternative of rejecting the pleasure but avoiding resulting weight gain. Our own theory clearly defines the neuro-muscular component that causes the discomfort of anxiety, and explains anxiety by updating D and M's drive theory with modern concepts of incentive motivation that are rooted in actual neurological and physiological processes. Nonetheless, the essential element of both theories, that anxiety is reinforced by avoidance, is the same.

represent a train of distractions from the internet to phone calls that provide moment to moment alternatives to doing one's work. And so we feel tense, and this pain or 'anxiety' forces our hand to make one decision or other, or else to simply escape the situation.

Muscles work to speed decision making, and that's often a good thing, lest we forget the lesson of Buridan's mule, who was indeed a real stupid ass. The question you may pose however is what makes you the author so sure? Simple, if perseveration on cognitive dilemmas is the cause of tension, and apart from fear, is the *only* cause of tension, then all the remedies for tension or stress must overtly or covertly rely on the remedy we propose. In the next chapter, we will demonstrate just that.

Chapter 3

Rest Unexplained

An astute reader will conclude that my proffered procedure for relaxation is hardly new, and is incorporated in one fashion or another in the myriad relaxation protocols that are available to us from meditation to simply lounging on the beach. And the reader would of course be correct. However, as I will demonstrate shortly, it is my *explanation* that is new, and it is explanation that informs the procedures you may derive, the observations you have made and will make, and allow us to focus on the true dynamics of behavior, and to throttle them back and forth at our convenience confident in our predicted results. Explanations are simply interlocking descriptions of events from a variety of complementary perspectives that in turn can range from the simple to complex that allow us to predict and control our world. Explanations are refutable, or in other words, subject to criticism. They are mutable conceptual objects that give us direction in life, and at our call, can be used to predict and control our worlds. To be scientific is to not simply describe, but to explain, and even for the most mundane aspects of life we need good explanations.

For example, for every ailment from a headache to the common cold, you treat the symptom and/or you treat the cause, and you know how to treat it because from the most complex to the simplest metaphorical sense, you can ***explain*** it. Consider an ear infection. Our explanations for infection can range from the very complex to the very simple. But whether you're a microbiologist or a school

child, you nonetheless rely on simple explanations that like a rule of thumb guide you in your path. Anyone can explain what an infection is, and because of explanation we can be guided to the right remedy for its symptoms and its cure. We know that we can treat ear infections with antibiotics, pain relievers, bed rest, heat packs, or ear drops. All treat the symptoms, but only one remedy treats the cause. Because ear infections can be explained due to bacterial causes, we know therefore that antibiotics, or the body's natural immune response are the only cures. Thus, to cure an ear infection you take antibiotics, or you rest in bed or simply wait, and allow your own immune system to fend it off. However, you will still of course likely address the symptoms, and eardrops, warm compresses, and pain relievers will help.

But let us consider a time when we did not have an explanation for ear infection. That's easy to do if we back up our analysis two hundred years are so. If you lived in 1815, and if you were forearmed with a correct explanation of infection, you would know that bed rest and the passage of time would be the only cure, awaiting our body's natural defenses to cure us. You would know that warm compresses and holding the head up to drain the middle ear would be effective therapies not to cure but to mitigate infection. Because you have an adequate explanation of infection, you can reject other remedies of the time that by want of mere correlation with a good result, or confounded with faulty explanations, were given credence they did not deserve. That means that prayers, exorcisms, and quack tonics are ruled out, and if you have some chicken soup, you would know its limitations.

Because you have a good explanation of what infections are and what they do, you can treat with and avoid infections,

and know the difference between what treats the symptoms, what treats the cause, and what merely treats someone else's wallet. Your knowledge won't stop infections of course, but your ability to confront infection won't be stopped by bogus procedures that are informed only by tradition, old wives' tales, or dime store cures.
Above all, this little book attempts to provide a valid explanation of tension or stress. So how do we demonstrate this? A good explanation of course, but what does that mean? To have a good explanation, four criteria are necessary, simplicity, generality, testability, and justifiability.

A Good Explanation is Simple
Simple explanations are the coin of knowledge. They may be graduated to describe the same phenomena is greater detail, yet at root they can be understood as simple principles. We know for example that computer chips work with electricity and silicon and electronic gates, and that engines work through processes of internal combustion. We know also that organisms evolve, and that we get ill because of disease. These are simple explanations that we can easily ramp up to more complex explanations if we have the interest and the time. (And indeed the more complex iteration of my ideas is found in the appendix of this book) Yet simplicity remains key, for without it we are lost.

A Good Explanation has Generality
Explanations generalize to inform and improve current procedures, suggest new ones, and predict the failure of competing explanations and the procedures they entail. For example, understanding infection generalizes to many other diseases, and is a cornerstone to understand human

biology and modern health. Similarly, Newtonian physics describes not just falling apples, but shooting cannons and shooting stars and orbiting moons. Like a tool set, generality allows us to do many things using just a simple set of principles, but doing is also predicting, and good explanations must therefore be primed to not just succeed, but also to fail.

A Good Explanation is Falsifiable

A good explanation's predictions are clear and general, and thus can be refuted easily. Moreover, they invite challenge so that they may be improved and strengthened, or else discarded. If your calculations demonstrate that a cannon ball will go so far given a certain mass and velocity, it will, and in all circumstances and all times. The same holds true for every widely held scientific explanation, from the theory of evolution to the theory of relativity. But if there is just one circumstance where the theory predicts a result that doesn't hold true, then the theory must be changed or even abandoned.

A Good Explanation Justifies

Ultimately, it may be said that people take aspirin not because it is a mysterious cure for a headache, but because it the *only* cure for a headache. Not knowing how aspirin works means that you will be receptive to other nostrums for your pain backed by false promises and spurious correlations, but knowing how aspirin works eliminates the need to consider alternatives and makes its acceptance universal. Inductive reasoning, or inferring causality from correlations, only multiplies competing correlations, and no one choice can be completely justified. The best example of this is the uncertain justification of the practice of focal and

mindfulness meditation. Although the procedures behind meditation 'work', the fact that they are not completely justified by an adequate explanation limits its universal acceptance as the primary cause for relaxation and 'happiness'.

Given these criteria for a good explanation, the question nonetheless remains, is our explanation indeed good? So far, we have simply explained how muscular tension and relaxation occur, but does it work, and does it work in all circumstances that elicit tension? Our argument is that excepting circumstances where we are in fear, it does work, and has long been demonstrated to work. A key to the testability of our argument is the generality of our explanation. In other words, given the right perspective, has it been continually tested all along?

If cognitive perseveration is the primary reason behind the muscular tension that underlies our daily stress, then it logically follows that it is the core element behind our prescriptions for its relief. In other words, cognitive perseveration is the key to all instances of non-fear related stress, and is the core and often hidden principle for those procedures that are effective in reducing tension.

This is easily demonstrated through observation alone, gladly provided to us in the copious annals of the stress relief literature. However, procedures, no matter how effective, are no better than home tonics if they cannot be derived from explanation. In other words, to make a true chicken soup for the body or the soul, you need to know how chicken soup works. It's easy to come up with workable procedures or procedures which seem to work, and put off explanation for another time. For tension or 'stress' relief there seem to be hundreds of them, united in

their glowing promises rather than explanations. So, let us examine how they are united or disunited by explanation.

Well-Tempered Procedures

Focal Meditation

Focal meditation is the sine qua non of procedures that induce relaxation, which means that it is the premier procedure to calm one's body and one's soul. Nonetheless, it remains a procedure without explanation, which of course has not stopped the growth in its popularity and the ever-growing expansiveness of its claims, from consciousness raising to increasing human virtue.

Focal meditation simply involves sharply reducing all undirected and spontaneous what-if or discursive thinking as well as non-discursive purposeful or meaningful thinking in an undistracted environment while attending to a simple physical stimulus or cognitive precept. You are pretty much staring ahead and thinking of nothing while restricting or focusing attention to some real or virtual stimulus, thus narrowing perceptions as well as eliminating decision making. As essentially 'thought less' awareness, meditation is the best and most proven way to relax. In meditation, all spontaneous or discursive judgement or mind wandering is avoided, so there is no opportunity for it to transition into worry, rumination, or distraction, with the deactivation of the covert musculature or relaxation as the result. While meditating, you are not thinking about your troubles, but in reducing non-discursive thinking you aren't thinking about what to have for breakfast or the nature of the universe either. Thus, you become relaxed but are pretty useless to yourself and the world for the time being. As a method to achieve relaxation, meditation is thus

effective, but not practical, since it is only performed in restrictive distraction free environments.

Mindfulness

Mindfulness may be described as 'choice less' or moment to moment awareness. It is a state of active, open attention on the present, but without the requirement to narrowing one's perceptual field or focal attention. Mindfulness is like focal meditation because it also entails the avoidance of discursive thought or mind wandering, but without inhibiting awareness and basic interaction with one's perceptual field (walking, talking, driving, etc.), or rudimentary non-discursive thought. The result again is a pleasurable relaxed state, as the avoidance of mind wandering prevents thoughts from segueing into cognitive perseveration.[6] It is to be noted that our definition differs

[6] **Perhaps the best way to understand mindfulness and how it is presented is to understand magic. Acts of magic involve the magician's connection of simple actions (pulling a rabbit out of hat) to unknown or 'magical' mechanisms by hiding or obscuring alternative independent measures or procedures that imply less arcane or 'miraculous' causes. This occurs when the mechanism of action (trap door under table) is obscured by the magician through a sleight of hand that focuses the attention of the audience on the odd behavior (wave of a wand) that merely correlates with the appearance of the bunny from the hat. The essence of the magician's trade is deflecting or obscuring explanation by diverting the audience's attention to absurd and fanciful procedures that have no causal link to any discernable process, but with a wink to telling the audience that a simple explanation really is available, at least when the trick is revealed. To pull a rabbit out of a hat, once explained, is *old* hat, thus the magician wants to keep up the mystery, and surrounds the real and simple explanation with a lot of**

from other conceptualizations of mindfulness because it does *not* include extraneous and imposed cognitive operations such as 'acceptance', curiosity, trust, attention to breathing, gratitude, etc. that confound the simplicity of the procedure and its explanation.

Mindfulness and Priming

Mindfulness and focal meditation require the suppression or avoidance of discursive and non-discursive thought, resulting in the default cognitive state of moment-to-moment non-judgmental awareness. Nonetheless, one can still be non-consciously or consciously aware of or alert to judgements that will occur subsequently to meditative sessions, and the affective awareness of the relative salience or importance of future events, or 'priming' can influence the affective tone of meditative states, or how good or bad it feels.[7]

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gesticulating with magic words, hand gestures, and the waving of a magic wand. In a similar way, unexplained yet effective practices such as mindfulness have an aspect of magic. It helps that mindfulness has diverse meanings, so it can mean veritably anything. So, if you are taking a time out from distraction and just being in the moment, adding in superfluous procedural layers like deep breathing, intonations to be loving and kind, psychotherapeutic jargon, and four-day training seminars full of new age cant is easy to do for what amounts to a simple psychological hat trick.

[7] It must be noted that although many studies that justify meditation duly contrast meditators with subjects who have undergone relaxation training, comparing control group subjects who use different relaxation induction procedures (e.g., eyes closed rest, progressive relaxation) with groups of meditators who become similarly relaxed imputes that the relaxed states across both groups are the same because those

techniques are equally efficacious in producing rest, an assumption which is empirically unfounded, since rest is not a single state, but occurs in degrees. For example, progressive relaxation entails learning how to relax major muscle groups, whereas deep rest entails relaxing all striatal muscular groups. Indeed, if meditation produces benefits above and beyond that of relaxation, rather than offering merely a better way to relax more completely, the degree of neuro-muscular inactivity or rest (as measured by SCR-skin conductance response or GSR-galvanic skin response to record electrodermal activity) must be held *equivalent* for both experimental and control groups, a criterion that has not been met by any studies that compare relaxed states in meditators and non-meditators.

Secondly, the neurological correlates of relaxation that render affect also are ignored in the meditation literature. Meditation is primarily justified for its affective (a feeling of pleasure and avoidance of pain, or tension) rather than behavioral (more effective cognition, changes in brain morphology) results, yet it is an established fact that resting or relaxed states activate opioid systems in the brain and attendant feelings of pleasure, with no evidence to suggest other causal mechanisms in meditation for reported pleasure. Indeed, the empiric literature in neuropsychology on meditation does not account for the affective nature of meditation, and focuses instead on the activity of cortical structures. This neglect calls into serious question the explanatory power of current neuro-psychological studies of meditation, which do not address and thus cannot justify rest and meditation as different affective states that have dissimilar causes.

Finally, there is the issue of the imperfect semantics or independent measures of meditative protocols, or what meditation procedure in fact entails. In other words, how a meditation protocol is defined does not necessarily reflect the cognitive operations that are characteristic of the protocols that invariably entail rest. For example, meditation may be defined as attentive focusing on a simple precept or word, however

For example, a fisherman attending an active fishing line may be in the moment with nature but is nonetheless affectively aware of or is alert to the likelihood of the future moment when a fish is on the line and that he must make multiple and presumably positive decisions. Similarly, for variants or enhancements to mindfulness such as 'savoring', 'gratitude', or 'loving kindness' meditation when a meditator is alert to subsequent meaningful behavior, the meditator also can experience added positive affect which can change the affective tone of mindfulness. The influence of this priming effect on resting states is of signal importance to its affective and motivational properties, as we will explain and procedurally address in chapter 7.

The Relaxation Response

Postulated by the cardiologist Herbert Benson, the 'relaxation response' is quite simple, and simply involves the rudiments of focal meditation, which is merely to sit in a quiet distraction free place and clear the mind of thoughts by reciting a simple precept or nonsense word. Aside from his dubious and unexplained position that the non-response of relaxation is in fact a response, discursive thinking is also

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attentive focusing in meditation also entails the consistent avoidance of perseverative thought for a significant interval of time, which is clearly a resting protocol. It may be argued that embedded in all meditative procedures are resting protocols that by ignorance or design are ignored or discounted through the sole attribution of the effects of meditation to obscure attentive or other cognitive causes.

avoided in such settings, and as with focal meditation, unnecessarily eliminates as well non-discursive or directed or purposeful thought. Indeed, the avoidance of discursive thinking or mind-wandering explains the ubiquity of relaxation in modern life, where to be relaxed doesn't require any focus at all.

Just Plain Rest

Lounging around and relaxing is the simplest way to rest, but is guided by the false notion that for rest, doing nothing is a proper substitute for thinking of nothing, or in the case of non-perseverative thought, thinking of something. Yet you can still relax while playing a game of chess, chopping wood, or pondering the nature of the universe and you can still be tense while in your moment of languor you are distracted by a nagging wife and needy children. For just plain rest, discursive thought is not inhibited, however the absence of perseverative thought is inadvertent, not planned, and can occur in parallel with any overt behavior. 'Just plain rest' is not informed by explanation, and although it may also engage the reduction of perseverative thought, it may not do so with the consistency required to fully produce a relaxed state. Indeed, the superiority of meditative techniques to just resting is because they require a consistency in the inhibition of discursive thought.

Better time management, improving skills, avoiding traffic, avoid arguments, positive thinking.

Improving your interpersonal and professional skills certainly ensures that there will be a lot less to worry about, but in comparison to generations past, we already *have* a lot less to worry about. That of course hasn't stopped a new age of security and abundance being labeled an 'age of anxiety'.

The issue ultimately is not improving skill sets, but a continuing justification of a life full of worry and distraction. The issue ultimately is not practical, but as we will note in the final chapter of our book, philosophical.

Add more distraction

Novice sailors are warned that if they get thirsty, drinking sea water will assuage their thirst, but only for a short period, when the added salt compounds the thirst. Similarly, when we get bored or stressed at work, taking time out to access novel events such as social media, email, or simply chatting with a coworker reduces our tensions or ennui, but only for a time, and at the cost of creating another affective or distractive choice which conflicts with the rational utility of our present work. So, we remain stressed not only because of the conflicting choices reflective of the task at hand, but become *more* stressed because of distractive choices that are now an option.

Deep breathing, guided imagery, progressive relaxation, taking a herbal bath, stretching, getting a massage, rocking in a chair, counting sheep, taking a nap, or any other of the 540 or more ways to reduce stress.

Recipes for stress relief are like all recipes, the cure is the same but the secret is in the ingredients, which differ only in type, measure, application, and name. The permutations of such things make for stress remedies, and from a simple perusal of the stress relief literature, indeed they are. Stress tips are ubiquitous, and without them all the magazines on the checkout line of your local supermarket would be a lot thinner. Like diet and dating advice, stress remedies rarely differentiate between symptom and cure, and may only partially address the problem. Because stress tips don't

derive from explanations, but mere experience, they cannot be judged against the metric *of* explanation. To relax means that you must *consistently* avoid *all* forms of perseverative thought from worry to distraction, not just treat the neuro-muscular symptoms of that thought. Comprehensiveness is key, you must touch all the bases, not a few. Besides lacking a good explanation, prevalent stress tips lack consistency. Thus, you can still suffer distractions or worry while walking on the beach or rocking on a chair, and to reduce the symptoms with a hot bath or massage does not eliminate the cause.

Despite the imputed generality of eliminating perseverative thought to achieve relaxation, the generality of our hypothesis must also apply to those situations that cause muscular tension, or stress. It is to that issue that we will now turn.[8]

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[8] A **Note on Resting States, Resting Brains, and Meditative States**

A resting state, or *'somatic rest'*, would seem to correspond with a brain at rest or *'neurologic' rest*, but by definition, somatic and neurologic rest are entirely different things. A resting 'state' or somatic rest represents the inactivity of the covert striatal musculature due to the application of resting protocols (continual avoidance of perseverative thought represented by rumination, worry, and distraction). Resting states also are affective states, as they elicit opioid activity in the brain. Resting states in turn may occur in tandem with all levels of non-perseverative thought that are passive or active, from just passively 'being in the moment' or being mindful, to actively engaging in complex and meaningful cognitive behavior. The latter cognitive behavior is also additionally affective in nature due to its elicitation of dopaminergic activity, and resulting opioid-dopamine interaction results in a

perceived state of 'bliss' or 'flow'. On the other hand, a resting 'brain', neurologic rest, or the so-called *'default mode network'* is a specific type of neural processing that occurs when the mind is in a 'passive' state, or in other words, is presented with no or very limited cognitive demands. This results in 'mind wandering' that can segue into non-perseverative (creative thought) or perseverative thought (rumination, worry). A resting brain is due to a *level* of demand, not a *kind* of demand, as in somatic rest, and the latter may encompass different levels of demand or cognitive states with the same affective outcomes. In other words, affect is not dependent upon neurologic resting states, or the default mode network, as the affective outcomes of meditation are commonly replicated in cognitively active behaviors that are concomitant with somatic rest.

It is remarkable that in the literature of meditation, the neurophysiology of rest is not defined, with a similar neglect to how neuro-muscular activity is actively shaped by experience or learning, and how it in turn modulates affect. The importance of meditation is very real, and the meditative community is understandably averse to equating it with rest since it makes meditation less 'special' or less marketable. But that is my argument nonetheless, which in the end provides a better advocacy of meditation by denying that meditation elicits a unique physiological process or state, which like the concept of 'phlogiston', or the imaginary element that enabled fire, impedes rather than furthers scientific inquiry.

Chapter 4

A Matter of Stress

Stress is not just an academic concept, it is a daily and painful occurrence that impacts our personal productivity, happiness, and health, and understanding and treating it is a corresponding big business. Academic journals and the careers of countless psychologists have owed their existence to this emotion, and the sheer tonnage of commentary and study this emotion has wrought on the academic and popular imagination is extraordinary. Nonetheless, the causes of stress are quite simple, and can be rendered down to two simple themes.

Stress is due to Demand

*Stress is a problem when the **demands** on your time and energy go on all day, day after day, without letup- '***Stress for Good' Book**

*The technical definition of stress is the amount of energy you need to adjust to the internal external **demands** of your life in a given amount of time. Stress is the balance between what you have to do and the resources you have to do it with.-* **Frederic Luskin**[1]

*Stress is a mediational process in which stressors (or **demands**) trigger an attempt at adaptation or resolution that results in individual distress if the organism is unsuccessful in satisfying demand. -* **W. Linden**[2]

*Stress is the non-specific response of the body to any **demand** made upon it.* -**Hans Selye**[3]

Stress is due to Threat

*Stress is a physical, mental and emotional response to a challenging event — not the event itself. Often referred to as the **fight-or-flight** response, the stress response occurs automatically when you feel threatened.* - **Mayo Clinic**

*Stress happens when we feel that we can't cope with pressure and this pressure comes in many shapes and forms, and triggers physiological responses. These changes are best described as the **fight or flight response**, a hard-wired reaction to perceived threats to our survival.* **–Stress Management Society.**

*This combination of reactions to stress is also known as the **"fight-or-flight" response** because it evolved as a survival mechanism, enabling people and other mammals to react quickly to life-threatening situations… Unfortunately, the body can also overreact to stressors that are not life-threatening, such as traffic jams, work pressure, and family difficulties.* - **Harvard Mental Health Letter**

*The stress response is also called the **fight-or-flight response**, as identified by Dr. Walter B. Cannon of the Harvard Medical School almost 100 years ago. The stress response is a profound set of involuntary physiological changes that occur whenever we are faced with a changing situation. The stress response, critical to the survival of primitive humankind, prepares the body for a physical reaction to a threat - to fight or flee.* - **Benson Henry Institute**

And again, stress may not have a proper definition at all!

....there is no definition of stress that everyone agrees on, what is stressful for one person may be pleasurable or have little effect on others and we all react to stress differently. Stress is not a useful term for scientists because it is such a highly subjective phenomenon that it defies definition. -**American Institute of Stress**

…or maybe there is, and it starts with muscular tension!

First, ***the skeletal muscles contract*** *and the hypothalamus, a small neural center in the brain, reacts. The hypothalamus, among other organs, influences the autonomic nervous system, which involves involuntarily activities of bodily organs. It also mediates activity in the pituitary gland, which releases hormones into the bloodstream. Under stress, as the muscles tense, breathing becomes faster and deeper. The heartbeat quickens. Some blood vessels constrict, raising the blood pressure and almost closing the vessels right under the skin. The throat muscles and those in the nostril force these passages wide open. The stomach and intestines temporarily halt digestion. Perspiration increases, and secretion of mucous and saliva decreases. The pupils of the eye dilate involuntarily. At the same time the adrenal glands release two hormones, epinephrine and norepinephrine, which effect circulation, elevating heartbeat and blood pressure. These hormones signal the spleen to release more red blood corpuscles. They enable the blood to clot more quickly, and encourage the bone marrow to produce more white corpuscles. They also increase the amount of fat and sugar in the blood. While these events are occurring, the pituitary gland secretes two more hormones, abbreviated TSH and ACTH, TSH and ACTH increase the rate at which the body produces energy and which reinforce the signals*

sent to the adrenal glands through the autonomic nervous system. ACTH also causes the adrenals to release about 30 other stress related hormones43. **-Source: International Stress Management Association (www.isma-usa.org)**

So, in light of these common definitions, the causes of stress should be simple. Get a little tense while on the job, therefore it's because you are suffering from a minor fear reaction, a tendency inherited from your caveman ancestors who had to fight or take flight when confronted with cave bears and tigers. On the other hand, it may simply be a matter of wear and tear, the inevitable result of inescapable workaday demand. The problem with such explanations is that they are not explanations at all, but are mere metaphors, and upon simple reflection and a little scientific knowledge bear no relationship to reality.

So, does demand cause stress? It seems reasonable to assume that the simple act of responding to the cognitive demands of the day causes some wear and tear on the body, leaving one exhausted from a hard day of mental work. But this belies the fact that many mentally demanding activities from climbing sheer cliffs to doing creative work correspond to a state of serene calm and emotional pleasure. Demanding activities such as work-related pressure, coping with distractions, and worry about meeting a pending deadline do of course elicit tension, yet as a *type* of demand they differ from stress free demands because of choice conflicts, *not* choice content. In other words, a trivial demand such as fending off distraction is far more stressful than a major demand of creating a work of art or climbing a sheer cliff because the former represents choice conflict and the latter does not. So, does demand cause tension? Of course, but it is not *what* we are thinking about but *how* we

are thinking about it that is the root cause of tension. So, then you may ask, if conflict free 'demand' does not cause stress, then what of the 'flight or fight' response that is so commonly attributed to stressful events?

It is a fact that our voluntarily and involuntary muscles are driven by our emotions, particularly when we are afraid or fearful. This 'flight or fight' response, or as it is known today as 'flight fight freezing system', or FFFS makes your heart race, your internal organs shut down, and primes your muscles to act to defend yourself, or else run for the hills. On the other hand, the simple tensions that occur when we find it hard to make up our minds activate the postural musculature alone, a simple response that shares little in common with the complex neurological and muscular reactions which comprise fear. In other words, see a spider far away and our postural muscles will move because we think, but see a spider on your nose, and all your muscles and a whole lot more will move because we fear. Do these separate instances correspond to the same neurological causes? Of course not. In both cases, you are avoiding the spider, and yet in each case your physiological responses are distinctively different not only in degree but also in kind.

Moreover, in the former case your behavior is driven because you think, and in the latter, it is because you are in fear. The former is due to cortical processes, and the latter is due to more primitive neural processes, centered in the midbrain, that govern the emotion of fear. This is a very simple distinction, verified conceptually as well as empirically (see appendix for academic sources), but it has not been explained well or has even been entertained in the copious academic and popular estimate of stress. So, our

daily stresses and anxieties are distinctive from our fears. They are indeed *separate* emotions.

It is a remarkable fact that we've got stress figured out all wrong. Our hard-wired fear responses are responses to threat, not choice, and are governed by different neurological processes from those cortically based processes that underscore anxiety or tension. Secondly, neuromuscular tension due to choice conflict only activates the postural musculature, and the global changes in physiological activity, from a racing heart, hormonal changes, to enhanced alertness, vasodilation, hyperventilation, etc. simply are not characteristic of tension elicited by conflicted thought. Both muscular tension and relaxation are ultimately functions of the *relationship* rather than *content* of our choices. It would seem then that simply changing *how* we think than *what* we think of would be a snap, and that stress could be banished forever. That would indeed be the case if we were reasonable creatures, which as we will show in the next chapter, we are not.

Chapter 5
Affective Decisions

We begin our day, and likely all our days, unconcerned that a meteor will fall on our heads or that we will drop dead for any number of causes. It's simply a matter of just being there, since birth, with neither of these events happening to us, so far.

Now let us say that the grand prize in the Powerball lottery is now up to $500,000,000. Since the government has not enrolled us in the social perk of a mandatory daily enrollment in the lottery, we have never gained the experience of not winning. So, it is particularly novel that we now have the opportunity of winning a prize that has no more likelihood of coming our way than a meteor landing on our head. And so we buy Powerball tickets, and in spite of our knowledge of the impossible odds, keep our eyes and our pocketbooks open to new and unexpected possibilities that give new meaning to the phrase that our eyes are bigger than our stomachs.

The new un-likelihoods outshine the old un-likelihoods because that is how our brains proverbially shine, or should I say activate. For the purchaser of Powerball tickets, you can say he is literally of two minds regarding his choice. He knows that his odds are long and that the long-term predicted value or 'utility' of buying a lottery ticket is next to nil. However, because the idea of winning the grand prize is unexpectedly novel or new, the immediate or 'decision' utility of buying the ticket is driven by a simple positive emotion, or positive affect. In other words, in the present moment a lottery ticket has value, but in the longer

term it has none. For another example, consider a normal day at work. From moment to moment we can go about our necessary business, or take a moment to check our email, our social media page, chat with a coworker, or make an idle phone call. These behaviors have a predicted utility that diminishes to near zero the more often we do them within a space of time, but the momentary or 'decision' utility stays high because these behaviors are novel events with positive outcomes.

These examples demonstrate how the introduction of affect multiplies the dilemma of deciding between a bird in the hand and two in the bush to endless numbers of birds in endless numbers of bushes as far as the eye can see. The great majority of these choices have no future utility or value to us, yet we are torn between them nonetheless because one choice is affective and one choice is effective, choices that are hard if not impossible to reconcile.

So, what is the source of this positive affect? It is a brain chemical called dopamine, which is more formally regarded as a 'neuromodulator' which activates groups of brain cells to center attention and facilitate thinking, and is subjectively felt as a sense of energy, elation, or activation, but not ironically, pleasure. Dopamine is released upon the anticipation or experience of positive novel or discrepant events wherein moment to moment outcomes differ from what is expected, and scales in release (and corresponding affect) with the moment-to-moment importance or salience of resolving positive or negative act-outcome discrepancy, much as when gambler is more energized when the stakes are higher rather that low. To be alert and aroused is a perquisite for living, and the feeling of boredom that occurs even when one is engaging in pleasurable activity (eating an ice cream cone, resting) reflects the actual pain that is

present when dopamine levels are lowered due to a lack of novel or 'meaningful' activity. Dopamine activity is further depressed with the perception of events that have *negative* meaning, such as the imminent prospect of death and taxes, and the resulting and painful state of depression results in a loss of ability to focus attention and to think clearly. A primary role for dopamine is to change the importance or salience of moment-to-moment behavior. This momentary salience may or may not conform to the overall importance of an extended behavior sequence, but it does not and cannot *predict* the long-term importance of that sequence. For example, intermittent small wins on a slot machine increase the salience or moment to moment importance of each pull of the lever, and the decision utility of the moment may or may not conform to a winning jackpot, but it nonetheless cannot predict whether in the long run a jackpot will occur. Dopamine only influences the value of the here and now, but besides often setting us off in eccentric and wrongheaded directions, it makes cognitive perseveration not just optional, but almost guaranteed.[9]

In other words, we are literally of 'two minds' in many decisions, and that often entails cognitive dilemmas that would have been resolved in a second if affect had not skewed our thinking. So, we are susceptible to perseverative conflicts between nearby 'bright and shiny

[9] **And it may be argued, dopamine may be behind not just our distractions, but also our worries. For example, we may logically regard as extremely unlikely the likelihood that we have left our house unlocked as we embark on a trip, yet like the Powerball example, the affective value of that likelihood may skew our thinking, and have us running back to check on our house in what in foresight and hindsight is clearly an irrational behavior.**

objects' and the duller path of rational thinking and rational goals.

So, what's a thinking person to do?

As we will argue, there is a tried-and-true solution that is millennia old and is no less than a philosophical whack on the head.[10]

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[10] (And here is a more formal explanation of how affective choice relates to stress, based on the work of the neuropsychologist Kent Berridge.)

Our mammalian ancestors were motivated by events that had survival value, and these events were ingrained as the necessary pleasures of existence, such as food, sex, and drink. However, their world, as is ours, was uncertain, and evolution required an additional inborn 'instinct' to persistently drive an animal to convert the uncertain into the certain, the unknown into the known. This seeking or foraging instinct gave utility or value to moment to moment exploratory behavior. The foraging instinct is embodied in a state of arousal (rendered by mid brain dopamine systems) that incents an animal to render from uncertainty the safe and sure paths to the hedonic outcomes (rendered by mid brain opioid systems) of food, drink, and potential mates, and to indirectly insure that pleasures are not only assured for now, but in the days and weeks to come. For foraging animals, the utility of the present moment or *decision utility* generally conforms to the future or *predicted utility* of hedonic outcomes. When the animal is not foraging, it rests, which is also hedonic in nature due to similar opioid responsiveness to relaxed states. So, for foraging animals in uncertain environments, their motivation is sustained by interdependent or synergistic affective states or 'utilities' that are maintained by different neurological systems. For human beings, a widely help premise in philosophy is that the purpose of life is to maximize experienced 'utility', or pleasure. Pleasurable events are predicated in the future (food,

sex, shelter) and in the present (neuro-muscular deactivation or rest). Both are defined through the activation of opioid systems in the brain. But like our foraging ancestors, our day to day goals also embody a degree of moment to moment uncertainty that also activates dopamine systems that see us through our daily affairs. Unfortunately, whereas nature aligns decision utility with experienced utility, so that for animals foraging behavior is rarely in vain, such is not the case with human beings, who can create decision utility which is untethered to productive or valuable outcomes.

Decision utility that contrasts with predicted utility elicits an 'approach-approach' conflict between different values instantiated by different neurological causes that cannot be reconciled. Such 'distractive' events are correlated with neuromuscular activation that if sustained causes pain and that also eliminates the experienced utility or pleasure of relaxation. Decision utility is generally desirable only if it conforms to experienced utility, as it enables us to focus on obtaining pleasurable outcomes and sustain present pleasurable ones (relaxation). Animals in the wild are in general not stressed because nature aligns the utilities that guide their behavior. For human beings, this alignment is easily broken because of higher order processes of thought that maximize decision utility, but often misalign it with non-productive behavior. This is characterized in a modern world that is full of novel events that are important when they align with our productivity, yet are pernicious (as distraction) when they do not. It is up to *explanation* and informed individual choice, not government fiat, which permits us to sort them out.

Our freedom of choice is constrained by our explanations of how the world works. When our explanations are wrong, as they were in ancient and even recent times, then we are condemned to the medieval barbarism of pain and suffering. If the explanations are correct, then we can make the right choices that guarantee our pleasures, well-being, and human dignity. A proper definition of stress, based upon neurologically

Chapter 6

A not so new Rationalism

"There is only one way to happiness and that is to cease worrying about things which are beyond the power of our will." – Epictetus (ca. 115AD)

"Don't worry, be happy"- Bobby McFerrin (ca. 1988AD)

Times were tough all over. Thousands of illegal aliens were crossing the border, the economy was in decline, people spent their days in mindless and generally violent entertainment, the Middle East was in chaos, the environment was degraded and the prophets all agreed, the end of world was near. Our civilization will follow that of the Roman Empire, unless you are of course living during the Roman Empire, and then you've really got troubles!
So, let's go back two thousand years to the year 115. The Roman Empire was at its height, government was bureaucratic yet just, bread and circuses were free, and naturally, folks were miserable. It was the time of the Pax Romana, or Roman peace, but that didn't stop people, then as now, from complaining about the macro and micro aggressions that made miserable their days.
With a nascent Christianity and other oriental religions, the consolation of theology was that evil will get its due, that

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grounded principles of incentive motivation, is the first step in making this happen.

the meek will inherit the earth, there was a heavenly reward for putting up with all your suffering, and it pays to be loving and kind, even if you get shafted in the end.

So, what was the competing consolation of philosophy at the time? Enter the philosophy of Stoicism. The Stoics were pragmatic philosophers who looked to real world results. Their 'consolation' was no promise of heaven or divine intervention, but rather a philosophical whack on the head. Things may be hopeless, but that does not mean you should be hapless, and it was haplessness that was the true cause of our misery. Their primary advice was simple, stop worrying and fretting about things you have no control over! In other words, it is sheer delusion to consider worry and rumination as coping strategies because they will not get you any closer to resolving your problems. Cognitive perseveration is a waste of time and energy, and you should focus the things that you have control over, namely your own character, integrity, and personal virtue. Only then can you be truly happy, and happiness is a personal choice derived from reason, not a gift from the gods.

The Stoic ideal was frankly Greek rather than Christian in nature, but they were no slouches in ethics. Indeed, to them it was all that cognitive perseveration on hopeless choices and causes that make people into unhappy crude and brutish sorts. Eliminate the consternation between decisions you have no control over, and you will end up being the reasonable and relaxed sort that is after all your true nature anyways, and your personal character and confidence will gain from it to boot.

What the Stoics didn't have of course was an explanation as to why clear thinking was the one true road to emotional health and happiness. Because they couldn't explain their philosophy, they could not justify it, and Stoic teachings

became relegated mainly to Bartlett's familiar quotations. But with explanation, the Stoic ideal becomes not just practical, but wholly justified, and it is to our not so original procedure that in full circle we return.

Chapter 7

Parsing Happiness

"Finally, all might agree that happiness springs not from any single component but from the interplay of higher pleasures, positive appraisals of life meaning, and social connectedness, all combined and merged by an interaction between the brain's networks of pleasure and meaningfulness. Achieving the right hedonic balance in such ways may be crucial to keep one not just free of distress— but even to achieve a degree of bliss."- Kent Berridge[11]

How do you make a lion, a tiger, or a bear happy?
Simply put, you just meet their needs. Give them food, drink, a proper mate, and they will be happy. Well, almost. They also need the ability to roam freely in an uncertain environment. If not, as zookeepers would attest, the best cared for animal would quite literally go mad.
Animals know their needs are met because they can *feel* them being met, and feelings are *affective* states that are mediated by specific neurochemicals in the brain. The pleasures of life, from food[4] to rest,[5,6] are mediated by the activation of opioid nuclei in the brain (i.e. neuronal groupings in the midbrain), whereas a feeling of alertness

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[11] Kent Berridge and Morten Kringelbach, Building a Neuroscience of pleasure and wellbeing, *Psychology of Well Being: Theory, Research, and Practice 2011, 1:3* :

or arousal (but not pleasure) is mediated by dopaminergic nuclei that are activated by the experience or anticipation of novel or unexpected events that have positive outcomes, and scale with the importance or salience of those events.[7] Both opioid and dopaminergic neurons are located in adjacent locations in the midbrain, and opioids have an excitatory effect on dopamine systems and vice versa.[8] [9,10,11,12,13,14] Thus, not only do opioids increase dopamine levels; but opioid activity will be enhanced due to dopamine activation (with the caveat addressed in the note below that opioid neurons are not otherwise suppressed though normal metabolic processes (e.g., food satiation, stress) [15] [12]. This is also attested by self-reports of greater

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[12] It is important to note that in affective neuroscience, there is a robust research literature confirming opioid-dopamine interactions, but little to no confirmation of its converse. In other words, although pleasure will always result in attentive arousal, attentive arousal will usually not result in pleasure. Although it has been demonstrated that amphetamine, which increases dopaminergic activity, also increases the release of endogenous opioids (Calipari et al. (2013) and Colasanti et. al (2012), the stimulative effects of amphetamine are however attenuated when opioid neurons are suppressed through opioid antagonists such as naltrexone (Schad et. al (2002). It follows that dopamine will not activate opioid systems when the latter are metabolically inhibited. Thus, if opioid neurons are inhibited by homeostatic mechanisms such as food satiation or stress, dopaminergic activity will not stimulate opioid systems.

Another reason for the lack of confirmation for dopamine-opioid interactions may be due to the contrasting level of observability of the independent measures in each case. For example, in opioid-dopamine interactions, the independent or causal variable is a 'molecular' or discrete stimulus event, such

as the ingestion of food or drink that elicits pleasure and subsequently attentive arousal. However, for the converse of dopamine-opioid interactions, the independent variable is a 'molar' or non-discrete cognitive representation or act-outcome expectancy that induces attentive arousal and then heightened pleasure, as when food or drink tastes better when one beforehand is anticipating novel positive outcomes that induce dopamine release, such as the greater palatability of a glass of wine when one is at an expensive restaurant or sampling an expensive vintage. In affective neuroscience, molecular stimulus events are easy to isolate and control, particularly for laboratory animals, whereas molar cognitive representations or expectancies are not, and only become obvious through self-reports of human subjects who can confirm these expectancies and are markedly more capable of them through virtue of a larger neocortex, though these expectancies are often expressed in metaphorical terms such as gratitude, savoring, kindness, and so forth.

Overall, it follows that cognitive representations or expectancies that increase dopamine activity such as the anticipation or performance of highly interesting, meaningful, or engaging tasks will also result in similarly elevated levels of opioid activity, but *only* when the latter is otherwise unsuppressed through metabolic causes (satiation, stress). In addition, opioid release can be continually accentuated or tonically sustained (e.g. through eating or drinking, or the absence of muscular tension, or relaxation) state, with self-reports of higher pleasure and attentive arousal, or 'ecstatic' states increasing with the salience or importance of imminent meaningful events. (The latter is particularly evident in 'flow' experiences, as discussed in pp.112-117) In other words, dopamine induction will not stimulate endogenous opioids when opioid neurons are otherwise inhibited, with the sole and significant exception of increasing baseline or tonic opioid activity that is already occurring due to pleasurable activities

food palatability or pleasure under conditions of positive uncertainty.[16]

All pleasures are labile, or in other words, can vary in salience or intensity of 'feeling' in lockstep with the rise or fall of positive or negative expectations. However, although our common pleasures from eating to drinking are intermittent and quickly satiate, pleasure entailed by rest can be continuous, and will increase or decrease in intensity in relation to corresponding degrees of arousal. Thus, to maximize pleasure and arousal, both rest and positive expectations need to be simultaneously maintained. In other words, the opioid and dopamine systems activated by rest and positive expectancies interact *synergistically*, and their combined effects are greater than the sum of their separate effects. Maximize both concurrently, and in the case of animals at least, you will have a very happy critter

For human critters, we are distinctively different from animals because of a large neo-cortex that allows us to virtually render behavior and its myriad uncertain outcomes. In other words, we can mentally rehearse or

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from eating to rest, and will scale with the level of dopamine release.

As a final note, the inhibition or disruption of dopamine systems will not affect opioid nuclei but will reduce or eliminate desire or 'wanting' that these systems engage and thus merely appear to influence pleasure. For example, 'knockout mice' who have their dopamine neurons destroyed remain capable of responding to tasty foods, however their approach or 'wanting' such foods is disrupted. In common experience, dopamine suppression due to bad or depressing events will reduce our appetite or wanting for food but not disrupt the pleasure we experience from consuming food.

think through options and their outcomes prior to choosing them, thus giving them meaning. Depending upon whether these outcomes are positive or negative, the activity of dopamine systems will either be enhanced or depressed, and dopaminergic activity will also scale up or down with the importance of real and virtual outcomes gained or lost. We will define 'positive meaning' as the branching positive implications of behavior as perceived *virtually*. For example, recreating the super bowl on a video console has little meaning, but watching the real super bowl does, and doing a good deed, earning a degree, or completing a work of art bestows a sense or 'feeling' of honor, pride, or achievement that represent ever refreshing positive meaning. Contrariwise, behavior that is positively affective in the moment (overeating, watching TV in lieu of chores) may have branching *negative* implications that are also virtually perceived. This 'negative meaning' suppresses dopaminergic activity and is felt as the emotion of regret or depression, and the same reduction in dopamine also suppresses opioid activity, resulting in a reduced ability to experience pleasure, or 'anhedonia'.[17] We want to consider past and present behavior and the emblems of that behavior (trophies, rewards) to have positive and meaningful cognitive import that branch into endless positive and affective implications, that will in other words 'echo into eternity'.[13] When combined with the pleasurable affective

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[13] It is to be noted that the salience of the positive virtual branching implications of a behavior, or its meaning, is always dependent on one's history of reinforcement or reward. This behavioral 'contrast' demonstrates how previous expectations can raise or suppress the meaning of behavior to come. Thus, a fan of the Cleveland Browns would find a win for his team in the Super Bowl more meaningful (and more rewarding) than a fan

state of rest, a maximal state of pleasure and alert arousal will be achieved and will scale with the importance or salience of moment-to-moment goals and their virtual implications. These facts lead us to redefine rest as representing not a static but a *dynamic* affective state, as the opioid systems activated in rest are always positively or negatively modulated by dynamic or phasic changes in dopamine systems that are induced by concurrently perceived positive act-outcome discrepancies or expectancies.

The subtle but major flaw in most resting procedures (e.g. meditation) is that they eschew positive meaning, and diminish or dismiss the alert arousal that humans instinctively require to live productive lives, escape the pangs of boredom, and enhance the affective entailments of relaxation.[14] Conversely, a life of positive meaning but full

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of the New England Patriots, who has come to expect and predict such things. Similarly, a millionaire reduced to bagging groceries for a living would find his behavior far less meaningful or rewarding than a central American refugee is a similar state of need.

[14] This underscores a major flaw in meditation research that it does not address the *affective* component of meditative states, which clearly implicate relaxation and states of alert arousal and the perceptual events which elicit them. Meditation neuroscience research generally relies upon comparative data from meditators and non-meditator using fmri (functional magnetic resonance imaging) or brain scans (EEG) that respectively measure cerebral blood flow and brain waves. However, neither can isolate the neuro-muscular and neuro-chemical activity that correlate with subjective affective states, or how neuro-muscular activity is a function of cortical activity as mapped to experience or learning.

of irresolvable conflicts eliminates the pleasurable state of relaxation and replaces it with the pain of tension or 'stress', and later regret. Contemporary philosophies of life commonly separate the two, as if pleasure and purpose are entirely separate and often conflicting goals. Quite the opposite, they are interdependent. [15]

In addition, appraisals of the neural states of meditators do not use resting state controls, or in other words compare the neural activity of meditators with control subjects who have been simply instructed to relax through standard relaxation protocols like eyes closed relaxation and progressive relaxation. Because these research methods and tools cannot determine the etiology or source of the positive affect associated with meditation or distinguish between the separate neurological differences between rest and meditation, it is no surprise that meditation remains without an adequate explanation as a unique mental or brain state that is separate from rest.

[15] The study of the affective concomitants of a meaningful and focused engagement with the world is not new, and finds it best contemporary advocate in the work of the humanistic psychologist Mihaly Csikszentmihalyi, who coined the term 'flow experience' to reflect self-reports of artists, athletes, and other individuals who uniformly reported a very intense and positive affective state when engaged in tasks that had very high and consistent meaning that engaged their undistracted attention. The twain meets of course when our 'bottoms up' approach to affect interlocks with Dr. C's 'top down' perspective, which although highly metaphorical in nature, nonetheless conforms to neurological truths. A much more detailed analysis of the flow experience is found on pages 112-117) of this book.

Wither Meditation

The blessing and curse of intelligent life is that we are always trying to make some sense out of it. We don't wait for things to happen and instead are quick to model myriad as-if or transitive events. It is a sign of intelligence, creativity, and a source of our happiness as well as our woes. As a prerequisite for rest, the avoidance of cognitive perseveration (i.e. persistent worry, rumination, distraction) means that perseverative thoughts are not experienced at all, and to achieve this it logically follows that the as-if cognitive operations that may segue into perseveration must be reduced or inhibited. This is the rationale for thinking in the present tense, or 'in the moment', which is the core definition of mindfulness. Mindfulness avoids perseverative thought by radically reducing the idle strands of predictive thought or undirected, 'mind wandering', discursive, or 'as-if' thinking that can lead to cognitive perseveration and its manifestations of worry, distraction, and regret. During mindfulness sessions, by consistently focusing on the moment through the inhibition of mind wandering, as-if cognitions are inhibited, perseveration is avoided, and relaxation is achieved. ***Mindfulness is merely the persistent avoidance of mind wandering***, for when thought does not wander the mind stays in a present state without as-if judgements, and this is semantically equivalent to the cognitive state of 'paying attention to the present moment without judgment,' making avoidance of mind wandering and the accepted definition of mindfulness one and the same.[16] As a means of mental hygiene, mindfulness implies

[16]**Our definition of mindfulness as the avoidance of 'as-if' thinking or mind wandering provides a precise semantics or**

that the default mode of a happy life is a still life, a timeless life. But therein lies the rub. As we have noted, humans are imbued by evolution with an instinctive 'seeking' response that leads us to seek novel outcomes, and optimally, to seek a cascade of virtual future positive and novel events or 'meaning'. Thus, to be mindful is not enough, as being mindful alone ultimately invites boredom. Thus, mindfulness is a practice that can only be intermittently applied before one surrenders again to the siren's call of distraction and begins the Sisyphean process of a relaxed high followed by a stressful low. But to make meditation sustainable and increase its affective 'tone', a type of judgment must be introduced to follow it, and by doing so increase our ability to better manage our behavior, or self-control.

Self-Control

The concept of self-control denotes the rational consideration and discovery of the expected consequences of pursuing a course of action, or its expected utility. Thus our behavior can be shaped by our own volition as rational actors. These consequences, when considered in real time as inspiration or 'meaning', have affective value and

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meaning that limits any inferences outside what the term exactly denotes. In contrast, the concept of mindfulness is characterized by its uncertain semantics, as there is a multiplicity of definitions that include additional cognitive operations such as acceptance, curiosity, compassion, meta-cognition, transcendence, etc. that are themselves obscurely defined. Doubtless this has been an accelerant to the thousands of meditation articles now published yearly, though its cumulative wisdom is not above a certain skepticism.

reinforce moment to moment approach behavior. However, 'decision utility', or the value in the moment of a course of action, is also affective, and can be in line or at odds with the long-term goals or expected utility of a course of action. Thus one can pursue the long-term goal of productive work and still be diverted or distracted by stimuli (social media, rumination and worry, web surfing, small talk at work, etc.) that have little or no long-term value or meaning. This often causes tension and stress as one has to continually choose between choices of incommensurate value, or in other words, between distraction and productive work.

The logical answer to this problem is to increase the decision or moment to moment utility of behavior that is coherent with the expected or future utility of performance by increasing the former's affective value. In other words, by making productive work artificially more enticing in the moment, it is easier to crowd out distraction and focus on important tasks. We often non-consciously do this by waiting until the last second to accomplish a task, where moment to moment success is touch and go and elicits attentive arousal or excitement. In other words, we procrastinate. From heroically defusing the bomb in time to merely catching the bus on time, from our entertainments to our most banal day to day behavior, through the timing of our behavior we calibrate affect to induce the responses we logically need. A preferable approach to self-motivation or self-control without putting our behavior on the razor's edge of procrastination is not just making moment-to-motivated productive behavior more arousing, but also more *pleasurable*. To do that, we must first get relaxed, and that is where mindfulness comes in.

Mindfulness is merely the ongoing reduction or inhibition of 'mind wandering' or discursive thinking, or the random

ideation or thoughts that can easily transition into conflicted or perseverative thought (regret, distraction, worry) that is embodied by depression or anxiety. It also induces relaxation, which is pleasurable. This pleasurable state of relaxation in turn can be enhanced during meditation sessions through its association with an awareness of subsequent non-discursive or purposeful thought, or 'affective priming'. In this way, the affective tone or 'feeling' of mindful or relaxed states increases through the synergistic effects of aroused and pleasurable states. In addition, the decision utility or present value of moment-to-moment meaningful behavior increases, and with it 'self-control'.

Thus, to maintain a productive, stress free, and pleasurable day, the avoidance of all distraction, worry, and regret through the elimination of its precursor of undirected or discursive thought through mindfulness (or thinking in the present tense, or 'in the moment') combined with the priming effects of conscious or non-conscious anticipation or awareness of non-discursive purposeful or meaningful behavior occurring subsequent to meditation allows us to understand and face the reality of the incentives that drive our emotional (covert) and overt behavior, and through arranging them, control them. Because relaxation can become a constant factor in our lives, it also acts to inhibit the tension that would occur for active perseveration when dilemmas intervene, thus allowing us to focus more on behavior that counts. An awareness of meaningful behavior subsequent to meditation also acts to accentuate good feelings by increasing the pleasure of relaxation through increasing positive uncertainty or discrepancy during the practice of meditation, or affective priming. Conversely, this gives affective value to meaningful behavior, and

makes it seem 'autotelic', or reinforcing in itself, and crowds out the occasions we might have spent dwelling on other worries and concerns.

The Happiness of Pursuit

Happiness is an elusive concept, but if perceived through the prism of affect, can be defined simply as continuous arousal and pleasurable affect that emerges from a meaningful and restful life. Happiness is in other words a motivational constant, and is a dynamic rather than static state. **Happiness is living a life of undistracted and persistent meaning, practically achieved through rest alternating with a commitment to meaningful values**. It is the synergy of pleasure and arousal that emerge from rest and positive meaning, or as Berridge would describe it, 'a degree of bliss'.

This notion is in fact not new but finds its origins in the philosopher Aristotle's concept of eudaemonia, which attributes arousal and pleasure to a life lived according to reason. From his Nicomachean Ethics Aristotle argued *that eudaimonia, or living well, consists in activities exercising the rational part of the psyche in accordance with the virtues or excellency of reason Which is to say, to be fully engaged in the intellectually stimulating and fulfilling work at which one achieves well-earned success*.[18] The metaphorical concepts of 'stimulating' and 'fulfilling' can be mapped to arousal and pleasure centers in the brain that are activated not by some inner virtue or capacity, but through outside incentives as arranged by an individual and the primary (family, friends) and societal institutions that he selects or which select him.

To love and do productive work was Freud's maxim for happiness, our similar notion is rather to relax while doing productive work. Both are intoxicating, but the latter

requires an easier route for the pleasures which animate our life. Ultimately, self-control is not the secret to happiness, it is happiness itself, and comes free of complexity, controversy, or cost.

A Postscript to a Preamble[17]
The Dynamics of Resting: from Process to Procedure

Theoretical Foundation

Conforming to experience and affirmed by affective neuroscience, all pleasures are 'labile' and can be accentuated or depressed depending upon a respective concurrent high or low state of attentive arousal. For example, consuming food or drink is tastier when we are expecting or experiencing novel and positive information and loses taste when we are not. Thus, food tastes better while watching an exciting movie or game, and much less so if the movie or game is depressing. This principle is described in affective neuroscience as opioid-dopamine interactions, or when opioid (pleasure) and dopamine (arousal) neurons in the midbrain interact. Since resting or

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[17] **Like an Oreo cookie, long explanations are best sandwiched in between shorter ones that as befit our hurried lives, get to the point. And good explanations must always be brief, simple, and easily testable, preferably by just going outside and taking a look. Galileo had this smart idea, and invited his academic peers to take a look through his telescope to prove that the planets indeed had circular orbits around the sun, and not the earth. To his dismay they refused, which proves the maxim that you can bring a horse to water, but…. (oh yes, and my preamble or other side of the cookie is on Pp. 5-6)**

relaxed states are also pleasurable, it follows that pleasure in rest will also be accentuated or depressed with 'good' or 'bad' expectations. This can be demonstrated through a simple procedure that also has therapeutic value and can explain a core neuro-physiological mechanism behind the efficacy of various therapies from ACT to mindfulness to how the placebo effect works in psychotherapy.

Procedure: Frequent switching or alternation (generally within one-to-three-hour intervals) between a resting protocol (e.g. mindfulness) and the pursuit of meaningful behavior will increase motivation and positive affect (arousal and pleasure) and counteract tension and anxiety. In addition, the more meaningful or important the behavior, the greater will be concurrent positive affect. In this way, the inhibition of mind wandering through mindfulness protocols is continually reinforced and sustained by enhanced pleasure and arousal, making mindfulness practice much easier to sustain and anxiety and stress much easier to avoid through the inhibition of subsequent rumination. Timing for alternation can be quite variable and does not diminish the effect, with 40 minutes being mindful alternating with 20 minutes meaningful behavior, or vice versa.[18]

[18] It should be noted that the value of meaningful behavior is judged not just by its predicted utility but also by its *timing*. So doing housework will have greater value during morning hours whereas taking on that great novel which you have always postponed reading will have greater value in the evening. So, these contingencies are arranged not only by what you could do but what you *should* do per time of day or situation, as meaningful work and play can be less than meaningful if you perform them at inappropriate times or circumstances.

Explanation: Resting elicits opioid activity, or feels pleasurable, and meaningful behavior, as defined as behavior that has branching novel and positive outcomes (writing that great novel, being compassionate or grateful, or just making the bed) elicits dopamine activity which causes attentive arousal. The awareness of subsequent meaningful behavior while engaging in relaxation protocols such as mindfulness elicits a 'priming' response, namely dopamine release that increases opioid activity, and vice versa, making meaningful behavior seem self-reinforcing or 'autotelic'.

Although mindfulness reduces discursive thought or 'mind wandering' that leads to rumination; it does not inhibit concurrent non-conscious awareness or anticipation of behavior or events subsequent to meditation that can in turn shape or 'prime' affective responses during a meditative session. A priming response, like the salivary response that precedes food or the sexual arousal that precedes intimacy, is a preparatory response that often occurs non-consciously, and changes the affective value or 'feeling' in the moment. Similarly, relaxing or 'being in the moment' is pleasurable, but if we were told to expect 'bad' news or 'good' news in the near future, just the awareness of future events is enough to depress or elevate our feelings but not altering in the slightest our 'mindful' or relaxed state. It follows that if mindfulness is paired with the awareness of subsequent positive or meaningful behavior, then rest in mindfulness will have a greater affective tone or 'feel better' than if such a prospect was absent. This is perhaps why 'savoring', 'loving kindness' meditation, and 'flow' experiences represent highly pleasurable and arousing experiences that

map positive ideation to relaxed states and can be contrasted with a lower level of pleasure during typical states of rest that generally precede a return to meaningless discursive thinking.

Another way of describing this procedure is as 'acceptance and commitment', wherein one is aware of the slings and arrows of outrageous fortune, but accepts them as facts without proceeding to contest, reinterpret, or remediate them through rumination, worry, or regret, while concurrently aware of meaningful behavior to come. In other words, acceptance inhibits discursive or 'what if' thoughts or 'mind wandering', and implicitly entails rest through its avoidance of cognitive perseveration, while commitment represents an awareness of the imminent pursuit of meaningful behavior.[19]

And what does Tom Cruise have to do with it? Another way of illustrating our argument.

In a TV sitcom, Rob was talking and looking at his wife while eating a chocolate cake. He suddenly turned to look at the cake, and said, "What am I eating, this is delicious!" "That is a chocolate cake!" she replied. "Why didn't you tell me?" he exclaimed in anger, "That is my favorite dessert!" The moral to this story is that you can enjoy your food more if you just pay attention and savor it, or more accurately, expect more pleasure than it would normally bring. The fact

[19] This procedure is notably similar to acceptance and commitment therapy, or 'ACT', however its genesis is different as ACT is derived from a behavioristic theory of language whereas our procedure is based upon a neuro-biologically grounded theory of incentive motivation. In more formal terms, ACT is based on a 'methodological' behaviorism whose terms are mapped to inferred cognitive processes, whereas our model is derived from a 'radical' behaviorism that uses terms that are grounded to real and observable neuro-biological events.

that novel and positive expectations, from eating popcorn at an action filled Tom Cruise movie to the taste of wine from an expensively labeled bottle of an otherwise common vintage always increases pleasure was demonstrated by recent experiments linked here in a recent journal article by Rauwolf et. al.

The question is whether positive expectations can enhance *all* pleasures, and this question can be tested by coupling positive expectations with other pleasures, such as those entailed by rest or relaxation. That of course is our proposal we have just enumerated.

But this still begs the question as to why. In modern affective neuroscience, affect or 'feelings' are governed by the activity of two small groups or nuclei of neurons gathered in separate 'hot spots' in the mid brain. No bigger than the nub of a pencil eraser, these nuclei separately govern pleasure and attentive arousal. They also interact with pleasurable events eliciting attentive arousal and in certain cases vice versa. These opioid-dopamine interactions can explain not only why attention increases when we sample a tasty food, but its converse as dopamine-opioid interactions also explains why the pleasurable experience increases if this is coupled with positive expectations of its quality, rarity, and sensory aspects, or even positive expectations unrelated to aspects of the pleasure, such as the increased savoriness of snacks while watching an exciting movie. These interactions can be manipulated to increase our attraction to behaviors we would normally avoid, and we see this in common marketing practices from eating popcorn at the movies to the ambience and novelty of a new car, restaurant, bottle of wine and so forth. These interactions can also explain the non-analgesic, yet pleasurable effects of positive

expectations mediated by false attributions of the curative powers of a spurious psycho-therapeutic procedure or medication, when anxiety is replaced by calm and positive expectations of a cure, or a 'placebo' effect. That these same procedures can be extended to enhance our own personal motivation to be productive and to avoid distracting and hurtful emotional thought can be demonstrated through simple procedure as we have described. Whether it works or not, only the future can determine.

Why mindfulness ain't got no body
A personal note on personal procedure

It is well known that mindfulness as a resting practice, if it occurs concurrently with an awareness of impending acts of kindness, gratitude, commitment or any meaningful ideation or behavior, positive affect or pleasure will also increase. The question is whether this pleasure occurs because of how the brain responds to the conjoined activity of neuro-muscular circuits (relaxation) and cognitive events or cognitive events alone, of which the latter perspective is characteristic of all explanations of meditation to date. The synergy of mind and body represents the concept of 'embodiment', wherein bodily and cognitive events are conceived as one interactive system. This can be explained through affective neuroscience, as I propose, but it can only survive as an explanation if it provides not just validating but better procedures. It is my novel and simple explanation of the dynamics of the affective component of rest, namely the modulation of opioid systems in resting states, that needs to be tested, (and quite easily as I argue) and it hasn't to this point because the neuropsychology of relaxation is not a subject of interest in psychology because relaxation is presumed to be a dormant and undynamic neurobiological

process. Whether psychologists will ever renew this interest only time will tell.

Mindfulness is a resting protocol, and rest is a dynamic and not static process. As such there is no distinct mindfulness process apart from the avoidance of mind wandering leading to rest. This is not to denigrate the *procedure* of mindfulness, quite the opposite, but to infer unnecessary distinctive mindfulness processes, much like false process entities such as phlogiston, ether, and hypnosis only impedes science and causes confusion which I fear the literature of mindfulness is rife.

Finally, mindfulness has more flavors than Baskin Robbins, when it should always be vanilla, coupled with a sprinkling of high hopes and best intentions!

The neuroscience and practice of well-being and enhanced motivational control: a summary of my key arguments

Dopamine release (causing attentive arousal or a feeling of energy) due to the anticipation of imminent novel positive events will stimulate opioid neurons (causing pleasure), but *only* if the latter are unsuppressed, and are already activated through their normal eliciting stimuli (eating, drinking, relaxation). This conjoint feeling of energy and heightened pleasure leading to increased meaningful activity, or 'well-being' or 'flow', can be demonstrated empirically and reproduced and sustained procedurally.

Foundational Assumptions

1) The anticipation of a chain of positive novel outcomes to behavior or 'meaning' will stimulate dopamine release, with dopamine activity increasing with the increase in meaningful value,

and in turn adding 'affective' value to that behavior and increasing incentive motivation towards meaningful values.

2) Eating, drinking, and relaxation will stimulate opioid neurons and are felt as pleasure. Opioid activity will always be stimulated by and rise with the level of dopamine release but will *not* respond to dopamine activity if opioid neurons are metabolically inhibited or suppressed, as for example, with food satiation, anxiety, tension, or stress.

Empiric Arguments

Scalability of pleasure elicited by internal stimuli (resting states)

Mild and sustained pleasure occurs while relaxed, with pleasure increasing with the importance of present and anticipated novel positive and meaningful outcomes and in turn increasing the valence or affective utility of those outcomes.

Example: creative behavior, savoring, extreme sports, 'flow experiences' (pp.112-117).

Scalability of pleasure elicited by external stimuli (food, drink)

Food palatability increases with the level of anticipated or experienced positive novel outcomes.

Example: Enhanced taste or pleasure of food and drink due to generalized positive 'uncertainty' unrelated to the sensory attributes of these stimuli.

(see article by Rauwolf et. al).

Relaxation protocols and scalable pleasure

The sustained pleasure resulting from relaxed states induced through relaxation protocols (e.g. mindfulness) increases with the importance of present and anticipated novel and meaningful positive events and reciprocally increases the incentive value of those events.

Empirical basis: When relaxation is paired with anticipated meaningful behavior (productive work, loving kindness, gratitude, altruism), pleasure will increase, and meaningful behavior will have increased incentive value. These practices may be abstracted to a simple procedure that allows this hypothesis to be easily and personally tested.

To wit:

Procedural Frequent switching or alternation between a resting protocol (e.g. mindfulness) and the pursuit of meaningful behavior will increase positive affect or well-being (arousal and pleasure) and counteract tension and anxiety. Positive affect will also increase in tandem with the increase in the importance or meaning of behavioral outcomes and increase the salience or importance of those outcomes.

And what does AI have to say about my procedure and theory? An astoundingly acute critique below, after submitting the preceding 2 pages to Google AI and waiting five seconds, a bit long in AI time!

Here are some comments and criticisms of your argument, presented in the constructive spirit you invited.

Core theoretical strengths

- *Integrates Berridge's wanting/liking distinction: Your model effectively incorporates Kent Berridge's core insight that the dopamine-driven "wanting" (incentive salience) and opioid-driven "liking" (pleasure) systems*

are distinct but interact. The model's proposed mechanism, where the anticipation of novel, meaningful events (dopamine/wanting) boosts opioid/liking during rest, is a sophisticated application of this principle.

- *Draws from broader affective neuroscience: The connection you make between positive emotions and the brain's reward pathways is well-supported. Research shows that positive affect can activate the ventral striatum and other reward areas. The "broaden-and-build" theory of positive emotions also supports your idea that positive affect, cultivated in moments of rest, can expand one's resources and lead to future success.*
- *Grounded in mindfulness research: The use of a "resting protocol" like mindfulness meditation is a robust and evidence-based practice for enhancing well-being. Studies consistently show it can improve attention, emotion regulation, and overall psychological health. Your proposal to interleave this with meaningful action echoes components of other interventions like Acceptance and Commitment Therapy (ACT), which emphasizes taking "valued action".*

Potential criticisms and refinements

1. *Causality vs. correlation: A core challenge for any empirical test will be to definitively prove that the alternation between rest and meaningful work is the causal factor, rather than simply the effects of mindfulness and meaningful work in isolation. People who engage in meaningful work often experience positive affect, and people who practice mindfulness report positive benefits. Your procedure would need to demonstrate that the synergy of the two, specifically via the proposed mechanism, is uniquely effective.*

2. *Operationalizing "meaningful behavior": The concept of "meaningful behavior" can be subjective and difficult to quantify for a study. While you provide examples like altruism or creative work, operationalizing a clear metric of "meaningful value" that is separate from the motivation (dopamine) or pleasure (opioid) it produces is challenging. A robust test would require a way to measure the "meaningful importance" independent of the hedonic or incentive effects.*
3. *The opioid suppression hypothesis: The idea that stress, anxiety, and satiation "metabolically inhibit or suppress" opioid neurons is a specific and strong claim. While plausible and consistent with some observations, this part of the model would require very specific, and possibly invasive, neurological measurements to test empirically. The evidence for mindfulness's anti-anxiety effects is strong, but linking this directly to opioid release specifically during the state of rest is a more granular and complex hypothesis.*
4. *Novelty and expectation effects: Your model hinges on the "anticipation of imminent novel positive events." However, the positive benefits of meaningful, valued behavior are often enduring and stable, not always tied to novel or imminent outcomes. A test would need to distinguish between sustained, long-term meaningfulness and the short-term burst of novelty. Mindfulness practice itself is about appreciating the present, which may be at odds with an intense focus on future novelty.*
5. *Replication of the Rauwolf finding: While you cite Rauwolf et al. as an example of enhanced food taste due to "generalized positive uncertainty," locating a specific paper detailing this exact mechanism is difficult from the*

search results. Other studies point to different factors influencing food palatability, such as social norms or repeated exposure. For the scientific community to engage with your work, this specific reference would need further clarification or empirical support.

Practical implementation and testability

The simplicity of your proposed procedure is a key strength for a personal test: "Frequent switching or alternation between a resting protocol (e.g., mindfulness) and the pursuit of meaningful behavior..." This is a valuable, easily implemented intervention.

As a psychologist, you could design an empirical study around this with the following elements:

- *Experimental group: Participants practice regular, structured alternation between mindfulness and meaningful work.*
- *Control groups:*
  - *One group practices mindfulness only.*
  - *Another group engages in meaningful work only.*
  - *A final group practices a non-mindful resting activity.*
- *Measures: Participants would use surveys and logs to record levels of positive affect, anxiety, and self-reported meaning before, during, and after the intervention.*
- *Outcomes: The core hypothesis would predict that the alternating group shows the most significant, sustained increases in positive affect, meaning, and a reduction in anxiety.*

Summary

Your proposed procedure is a well-reasoned and theoretically sound application of advanced affective neuroscience, merging Berridge's work with established positive psychology interventions. Its practical testability is excellent, and it represents a compelling, focused approach to enhancing well-

being. The criticisms are not fundamental flaws but rather suggestions for how to strengthen the argument through more targeted empirical research. These refinements relate to isolating the specific causal mechanism and operationalizing key variables, typical challenges in translating complex neuroscience theory into psychological practice.

…and a second AI opinion

This is a compelling synthesis of ***incentive salience*** *(dopamine) and* ***consummatory pleasure*** *(opioids). Your argument effectively bridges the gap between biological drives and high-level psychological states like* ***flow*** *and* ***meaning****.*
By suggesting that dopamine doesn't just drive "wanting" but actually amplifies "liking" (provided the opioid system isn't suppressed by stress), you've outlined a clear neurobiological path for ***sustainable well-being****.*
Here is a brief breakdown of your key points through a neuro-behavioral lens:

- ***The Synergy of "Wanting" and "Liking":*** *You've correctly identified that while dopamine drives the pursuit (anticipation), it requires a receptive opioid system to translate that pursuit into actual "well-being." This explains why "hustle culture" often leads to burnout; it's all dopamine with suppressed opioid receptors due to stress.*
- ***The Role of "Meaning":*** *Your focus on* ***meaningful value*** *as the primary dopamine trigger is crucial. It suggests that "flow" is essentially the neurochemical sweet spot where the brain's reward systems are perfectly synchronized.*
- ***The Alternation Protocol:*** *Your procedural suggestion—switching between mindfulness (lowering*

the threshold for opioid activation) and meaningful action (triggering dopamine)—mirrors effective ***oscillation models*** *in performance psychology. It prevents "hedonic adaptation" and metabolic inhibition.*

A final note: on mindfulness and meaning

Mindfulness to this author is as important for good mental health as a good diet is to physical health. Nonetheless, although mindfulness is commonly practiced it is far from *continually* practiced. Indeed, daily mindfulness practice scarcely averages half an hour a day even among advocates. The reason is not hard to find, as the inhibition of mind wandering, a key aspect of mindfulness, is boring, as humans are by nature attracted to the novelties of 'what-if' possibilities and judgments inherent in mind wandering. In addition, mindfulness takes time away from other productive pursuits, and hence the time spent being mindful is normally measured and low. So how can these issues be remedied to significantly increase daily mindfulness from minutes to hours?

The answer is surprisingly simple, and all comes down to cause and 'affect', or 'savoring' strategies that alternate mindfulness with novel and positive events such as attending to an excellent meal, kindness to others, gratitude, or other meaningful behavior. It follows that if mindfulness and its implicit avoidance of mind wandering becomes pleasurable due to its dependency or contingency upon alternative productive or meaningful behavior, then mindfulness can become more reinforcing in itself and so will meaningful behavior, with the only 'loss' counted in the hours of meaningless and distractive behavior that is an ever increasing portion of our lives in a world that continually steers us from the greater possibilities of being

human. But again, this argument is best resolved procedurally, and only time will tell if I am right.

Appendix

Now it's time for a more complex explanation. You know the sort, full of new words, inscrutable argument, and a list of referential sources whose validity you must take on the author's word but whose simple implications should be subject to challenge and refutation. In this section I will wade into the fine print of a higher order explanation for muscular tension and relaxation. For those wanting to delve into the finer print of my analysis I refer you to a journal article by this author that has long since disappeared into the Sargasso Sea of academic literature. This article was published in 2006 in the 'International Journal of Stress Management'. A second article worthy of note is David Holmes' critical survey of the meditation literature, which concludes that meditative states are merely resting states.
https://www.scribd.com/doc/121345732/Relaxation-and-Muscular-Tension-A-bio-behavioristic-explanation
https://www.scribd.com/document/291558160/Holmes-Meditation-and-Rest-The-American-Psychologist
For a more comprehensive overview of learning theory, and how 'affect' is essential for motivation and 'happiness', as well as the major practical and social implications of 'affective neuroscience', my little book linked below on motivation will hopefully entertain and educate. It is followed by a link to its acid companion, a caustic take on the social sciences that I hope will entertain and infuriate.

https://www.scribd.com/document/495438436/A-Mouse-s-Tale-a-practical-explanation-and-handbook-of-motivation-from-the-perspective-of-a-humble-creature
https://www.scribd.com/document/659384787/Galileo-s-Lament-and-the-Collapse-of-the-Social-Sciences

Finally, in the pages to follow I restate more formally my position and discuss the larger implications of an explanation of muscular relaxation and tension in the context of popular theories and schematics of emotion, which include the Yerkes-Dodson law, 'Circumplex' theories of emotion, and the concept of 'flow'.

The Rest of 'Rest'

Muscle Bound

Almost forty percent of our body weight is our muscles, comprising skeletal, cardiac, and abdominal groups, and skeletal muscles alone are over 620 in number. Naturally, understanding how these muscles work, grow, tire, and are repaired is important not only for health and fitness, but also in terms of how we move about and handle our world. Understanding how they work is also, as we have argued in our little book, about motivation.

For the striated or voluntary musculature, motivation is easy. Grasping, walking, talking, etc. occur or are 'emitted' because they are followed by or are 'reinforced' by specific discrete outcomes. We act in other words because actions do things. Because these behaviors uniformly engage a specific organelle of the body, namely the striated

musculature, a common presumption is that this 'operant' conditioning primarily reflects the activity of these muscles. Of course, convulsions, fear reactions, startle reactions, etc. *do* involve the striated musculature and can be mediated by neurological rather than purely cognitive causes, but in general muscular activity is guided by its functionality as consciously perceived.

It is commonly assumed that if striated muscles are activated, they may be observed by everyone, and thus everyone can see and agree to the obvious fact that they are universally correlated with getting things done, and are thus operant behaviors. Yet only a fraction of striated muscular activity is observable by anyone or even yourself. That is, the musculature may be activated yet not result in publicly observable responses, and neither may it be consciously or privately perceived by the individual. Ironically, the non-conscious activity of the musculature has long been made public through devices such as the skin conductance response (SCR) and electromyography (EMG), but rarely if ever has this behavior been hypothesized to respond to non-consciously perceived outcomes. Rather, muscular tension has generally been construed to be an artifact of autonomic arousal that is elicited due to psycho-social 'demand'. This interpretation regards muscular tension as controlled by different motivational principles from those that underscore voluntary or operant behavior, such as the reflexive or stimulus-response reactions entailed by a fight or flight response, stress reaction, etc.[19] In this case, inferred instinctive processes take the place of observed cause and effect relationships between behavior and outcomes.

However, this conclusion may remain uncontested not because the relationship between tension and a change in

overt behavior is disproven, or because the relevant data are unobtainable, but because of a common misinterpretation of the meaning of 'demand'. But before we delve into semantics of how we understand motivation, we must first understand how striatal muscles work.

The Striated Musculature

Although the activity of the striated musculature comprises most behavior as we understand it, its psychophysiology is not widely known. Muscle fibers are categorized into "slow-twitch fibers" and "fast-twitch fibers."[20] Slow-twitch fibers (also called "Type 1 muscle fibers") activate and deactivate slowly, but when activated they are also very slow to fatigue. Fast-twitch fibers activate and deactivate rapidly and come in two types: "Type 2A muscle fibers" which fatigue at an intermediate rate, and "Type 2B muscle fibers" which fatigue rapidly. These three muscle fiber types (Types 1, 2A, and 2B) are contained in all muscles in varying amounts. Muscles that need to be activated much of the time (like postural muscles) have a greater number of Type 1 (slow) fibers. When a muscle starts to contract, primarily Type 1 fibers are activated first, followed by Type 2A, then 2B. Type 1 fibers are often continuously activated because of psychosocial 'demand' that in general does not engage fast twitch fibers. For an individual, this activation is only indirectly observed when these fibers subsequently fatigue, causing exhaustion and pain.

Muscular activation also causes major changes in the autonomic nervous system. Sympathetic autonomic arousal is elicited through the sustained contraction of high threshold motor units (Type 2) of the striated musculature, as occurs during running or weight training.[21] But arousal

may also be mediated by the sustained contraction of small low threshold motor (Type 1) units of the striated musculature,[22] and can be measured directly through EMG (electromyogram) or through indirect measures of autonomic arousal (e.g., skin conductance response or SCR; galvanic skin response or GSR) elicited by tension induced arousal. Physiologically, the neural pathways that detail how muscular tension instigates autonomic arousal have been well established. [23] [24] [25] [26] Through a bi-directional connection between the reticular arousal system and muscle efferents, a dramatic decrease or increase in muscle activity throughout the body can respectively stimulate decreases or increases in sympathetic arousal. Critical to the reduction of sympathetic arousal is the elicitation of endogenous opioids through neuro-muscular inactivity that not only diminishes stress-induced neuroendocrine and autonomic responses, but also stimulate these effector systems in the non-stressed state.[27] In addition, tonic or sustained opioid activity down regulates opioid receptors, thus reducing the palatability of and craving for other substances (e.g. food or alcohol).[28] In other words, relaxation or resting not only counteracts the deleterious effects of sympathetic arousal, but is subjectively experienced as a state of mild euphoria or pleasure due to the concomitant activity of opioid systems.(1)

This striated muscle position hypothesis[29] holds that the critical controlling event for autonomic arousal is covert neuro-muscular activity, and that rapid striated muscular activity can "mediate and thereby control what has been called autonomic, cardiovascular, and electroencephalographic conditioning." The question yet unanswered is how covert muscular activity is conditioned.

Contingency and Demand

The contraction of Type 1 fibers occurs prior to and in tandem with type 2 muscular activation and is essential to voluntary behavior. Type 1 activation also occurs to prime an individual for action and as such is also dependent upon the anticipated results of that activity. It thus follows that Type 1 fibres are commonly activated due to perceived causes and effects or 'response contingencies'. However, if type 1 muscular contraction occurs without the subsequent activation of type 2 musculature, then involuntary or reflexive mechanisms are generally inferred to occur by the 'stimulus' of demand. For example, a worker who 'multi-tasks' between several tasks and is subject to the distractions of co-workers, email, etc., normally attributes sustained tension and emotional exhaustion to the 'demands' of working day. The metaphor of demand connotes a stimulus event that *elicits* tension rather than contrasting response contingencies that cause tension to be *emitted*. But does this concept of demand denote a true mechanism or is it merely a misrepresentation of the semantics or meaning of demand?

1. Neuro-muscular activity in the form of light aerobic activity (walking, stretching, doing housework) has also been hypothesized to increase endogenous opioids or endorphins (e.g. yoga), but only strenuous aerobic activity (e.g. long-distance running) has been demonstrated to induce the production of endorphins.[30] However, endorphin production is reflected in blood levels, and not in the brain. Endorphins in the blood cannot pass the blood-brain barrier, but the neurotransmitter called anandamide can, which is elevated after strenuous

exercise and *can* travel from the blood to the brain. Anandamide is as an endocannabinoid, similar to the psycho-activating element of marijuana, and it is also accompanied by the increase in serotonin or norepinephrine levels that in lower levels are correlated with depression. It is they and not endogenous opioids that likely constitute the 'runners high'.[31]

As popularly conceived, tension is a result of reflexive processes (e.g. flight or fight) that are elicited by a requirement for performance represented by 'threat' or 'demand'. But the requirement for performance entails a conscious or non-conscious appraisal of the consequences dependent *upon* performance or non-performance and the variability or likelihood of those outcomes. These represent future contingent outcomes. Thus, demand *must* implicate cause and effect, or contingency. Demand also entails the conscious or non-conscious appraisal of different response options or contingencies that lead to a similar end. Furthermore, demand occurs in a perceptual space that involves the concurrent consideration of alternative response contingencies that lead to dissimilar ends (e.g. distractions). In other words, *demand entails choice*. For example, a person confronting a demand to complete a project at work must choose between different response options (e.g. work faster, take short cuts), and his performance is further influenced by the availability of alternative response options (e.g. taking a break). Hence demand cannot represent a stimulus event that elicits behavior, but rather denotes alternative response contingencies or choices that lead to the emission *of* behavior.

Besides the cognitive element of demand, tension and associated arousal are also correlated with cognitive events

that represent abstract rather than normative (i.e. means-end) properties of a contingency. It has been proposed that discrepant, unpredicted, or novel events directly elicit alarm or arousal states.[32] A variant of this hypothesis proposes that discrepant events first elicit affective events which *in turn* "automatically and obligatorily elicit a somatic response." [33] [34] [35] In short, the "primary inducer is a stimulus in the environment (i.e. risk) that elicits an emotional response."[36] For example, a person winning the lottery or who suddenly learns he owes money on his income tax perceives novel rewarding or aversive outcomes, and feels tense because of the unexpectedness or novelty of the event or because of the affective events elicited by those outcomes. Nonetheless, the reflexive or 'automatic' link between somatic (i.e. sympathetic) arousal and unpredictable, discrepant, or risky events is not supported by the facts. Indeed, continuous positive surprise or discrepancy[37] as evidenced in creative and sporting behavior is highly correlated with profound relaxation and low autonomic arousal. For example, a rock climber involved in the 'touch and go' behavior of climbing a difficult cliff experiences low autonomic arousal or is 'cool under pressure' when his moment-to-moment risky behavior is successfully accomplished. Similarly, an artist in the thrall of a creative act feels elated but relaxed during the moment-to-moment novelty of inspiration. Finally, low autonomic arousal is characteristic when avoidance from surprising painful events (e.g. bad news) is impossible, as in the case of 'learned helplessness'.[38] Thus we may feel depressed and non-anxious when we learn of bad news wherein there is no recourse, such as a fatal illness, natural disaster, etc. As an alternative explanation, because affective events intrinsically change the value of the

behavior that accompanies them, this behavior may also contrast with other alternatives that have value derived from a cognitive or rational domain. In other words, emotional value alters the relative value of alternative choices, and hence may signal the emission of covert somatic (i.e. neuro-muscular) behavior. Thus, it is proposed that *discrepancy elicited affect does not directly elicit sympathetic arousal, but can indirectly establish a contrast between response alternatives that does*.

These concepts are easily illustrated through the facts of behavior. Specifically, sustained or 'tonic' levels of muscular tension are commonly produced under continuous or moment to moment alternative choices wherein any choice entails near equivalent feasible or avoidable losses, or dilemmas. These dilemmas may consist of two or more rationally comparable choices that are near equivalent (e.g. what choice to make in a card game) or two choices that represent affective choices or affective vs. rational choices that are near equivalent in value and cannot be logically compared.[39] An affective choice will be defined as an anticipatory emotion or more specifically, a priming effect due to the enhanced and sustained activity of mid-brain dopamine systems[40] that provide an affective value (or 'wanting') to engaging in or the prospect of engaging in positive unpredicted or novel events (e.g. checking email) or primary drives (e.g. 'wanting' an ice cream cone). *(2)* This activity may occur not only when a discrepancy is perceived (as represented by the primary inducer), but also from moment to moment *prior* to or in anticipation of that event (as represented by the secondary inducer). Thus, continuous decision making between alternative choices (e.g. doing housework or minding a child, working or surfing the internet, staying on a diet or eating ice cream,

keeping a dental appointment or staying at home) represents irreconcilable affective and/or rational alternatives wherein one choice entails the loss of its alternative, and is associated with sustained or tonic levels of tension that is painful. Called the 'Cinderella Effect' from the fairy tale character who as a harried servant girl was first to wake and last to sleep, [41] [42] [43] [44] the continuous activation of type 1 motor units or muscles (also called Cinderella fibers) because of this psycho-social 'demand' causes them to eventually fail, and thus recruit other groups of muscles more peripheral to the original group, resulting in pain and exhaustion. In addition, as the name Cinderella suggests, these slow twitch fibers are slow to deactivate, and will continue activated even during subsequent intervals of rest.[45] The aversive result of this long-term activation conforms to McEwen's model of 'allostatic load',[46] which predicts that tension and

2. The neuro-modulator dopamine is implicated in all learning and is released upon the anticipation or experience of novel or discrepant events wherein moment to moment outcomes differ from what is expected. Dopamine release increases with the importance or salience of an event,[47] and is felt as a sense of energy, or activation, but not pleasure. Thus, one feels more energized or elated upon winning the lottery if the prize is large rather than small. A major role for dopamine is to change the importance or 'incentive salience' of moment-to-moment behavior.[48] This momentary salience may or may not correspond to the overall importance of an extended behavior sequence. For example, intermittent small wins on a slot machine increase the salience or moment to moment importance of gambling even though

the long-term consequences (namely a large cumulative loss) is the inevitable consequence.

arousal will be maladaptive when there is an imbalance between activation and rest/recovery. Specifically, continuous low level or 'slight' tension results in overexposure to stress hormones, high blood pressure, and resulting mental and physical exhaustion. It must be remarked that in these examples slight tension is correlated with moment-to-moment choices between alternatives that have *low* salience and is characteristic of common day-to-day choices. However, if the choice salience was very high, wherein alternative choices represent highly salient possible outcomes such as matters of life and death, then tension and arousal would be much higher, and would be reported as anxiety.[49]

It must be noted that anxiety is a separate emotion from fear, or the flight or fight response. The flight/fight fleeing system (FFFS) is activated by situations that entail imminent threat. In the popular literature of stress, the FFFS is commonly invoked for autonomic arousal occurring across all threatening and non-threatening situations. However, for distant threats (e.g. a spider approaching from a great distance away as compared to a spider an inch from your nose), or for non-threatening choice/choice conflicts (e.g., distractive conflicts), the FFFS is not activated. Thus, covert neuro-muscular activity in these situations cannot be attributed to instinctive flight/fight neural mechanisms, but to cortical activity,[50] therefore implicating learning processes.

Finally, in addition to continuous choices, intermittent choices between conflicting near equivalent low salience response options also correlate with tension induced

arousal, and this activity is correspondingly intermittent or 'phasic'. Because tension is quickly followed by a period of rest and recovery, tension is still affective and painful, but it is not maladaptive.

Overall, whether continuous or intermittent, the demand reflected by near equivalent choices does not represent a discrete stimulus or stimuli that bypass cognition but rather comprises a cognitive event that denotes changing perceptual relationships between behavior and outcomes. These alternative choices describe responses that lead to primary gains at the cost of moment-to-moment opportunity losses. Thus, the primary gain of doing one's work or accessing the internet comes at the moment-to-moment opportunity loss of the novel event of accessing social media,

events that are not reconcilable logically since the former represents an effective or instrumental event and the latter an emotional or affective one. But what is the purpose of concurrent muscular activation? The sustained activation of type 1 fibers as elicited by the perception of equivalent alternative choices serves no direct functional purpose, but it may serve an indirect one. Ssustained tension is painful, and as a rule pain imposes a new action priority to escape pain and to avoid future pain.[51] That is, pain serves to initiate avoidance behavior. In other words, pain is something you wish to escape. Thus, the pain of tension may serve to motivate an individual to escape from 'no win' situations when confronted with choices that entail significant gains but also significant loss, and tension is thus indirectly reinforced by the avoidance of the situation. (3) But if tension is due to information about the consequences of behavior, namely the avoidance of the painful results of tension, how can this be demonstrated?

***3.* A 'no win' situation predicts significant gains as well as significant opportunity losses if an individual continues to perform under alternative choices. These anticipated negative changes are painful,[52] and the awareness of future pain may signal muscular tension and corresponding avoidance behavior.[53] [54] A 'no win' situation may be also defined as an 'approach-avoidance' conflict, wherein we are simultaneously attracted and repelled by a goal that represents both an opportunity gain and opportunity loss. This conforms to the Dollard and Miller theory of anxiety[55] that argues that sympathetic autonomic arousal or 'anxiety' is elicited by a choice conflict, and is reinforced by the avoidance of the choice situation.**

Resting Procedures

The argument for the operant nature of type 1 muscular activity is that if tension only occurs when decisions result in moment to moment or imminent feasible or avoidable (i.e., opportunity) losses due to near equivalent choices, then tension will *not* occur if there is no possibility of avoidance of future events, or no opportunity loss. That is, the loss remains, but the opportunity to avoid it does not. Thus, if tension occurs because it signals behavior that leads to the subsequent avoidance of the events that elicit tension, then it logically follows that tension is therefore 'reinforced' *by* prospective avoidance, and is an operant behavior.

A well-known procedure used to eliminate the ability to avoid loss while responding under multiple alternative choices is called an exclusion time out.[56] Common in educational environments, an exclusion time out describes a period when an individual is restrained from performing

all actions which are otherwise rewarding to extinguish targeted behavior (e.g. temper tantrums). Thus, a child under time out must sit and not participate with classmates, engage in learning tasks, read a book, etc. Although the child incurs and is aware of loss, the difference is that this loss is unavoidable or non-feasible. A time out is also a resting procedure. To rest is to take a time out from the choices or demands of a working day to achieve a state of relaxation. However, it does not implicate to what degree choices are reduced, mainly that they are. Thus, although resting may figuratively represent an exclusion time out, it does not literally match the definition. To do that requires a *radical reduction of choices that entail imminent (i.e., moment to moment) feasible or opportunity loss*, and this is implicitly or explicitly entailed in meditative procedures that inhibit all 'what-if' or discursive thinking or 'mind wandering' that can segue into cognitive perseveration. The research consensus is that meditative procedures and resting protocols correlate with an attendant state of relaxation.[57] [58] For meditation and resting, an individual may be aware of or is 'mindful' of irreconcilable choices due to rumination, worry, or distraction, but through the inhibition of discursive thought, tension is eliminated by the avoidance of choice.

However, although the result of relaxation is shared by meditative and resting states, the inferred causes for these have been expanded beyond the mere reduction of choice. Thus, for meditation, relaxation may not be primarily attributed to the reduction of choice, but to the manipulation of attention. This manipulation involves focusing attention on a stimulus event (focal meditation, Benson's 'relaxation response'). But as with the meaning of demand, the meaning of focused attention is also ill defined,

and must also entail the restriction of choice. In effect, the focusing of attention restricts choice by avoiding environmental events or the perception of the consequences of those events, which conforms to the definition of mindfulness as choice-less awareness.[59] Because meditation *must* entail moment to moment choice-less awareness or mindfulness, it may be inferred that the primary effect of meditation, namely muscular relaxation, is also due to the mindful or choice-less awareness implicit in meditation.

To reinterpret meditative and resting protocols as a 'time out' or 'choice-less awareness' makes the causes for relaxation equivalent. Thus, meditation *is* rest because their respective results *and* causes are the same. Because type 1 musculature is easily activated and is slow to deactivate, nearly all choice that entails moment to moment imminent feasible loss due to conflicting choices must be eliminated or deferred for a continuous period for the musculature to totally relax, and this is what meditative and resting protocols implicitly do, and for mindfulness procedures, it is what they *explicitly* do. Yet because muscular activation is not painful or harmful unless it is sustained, it is the *persistence* and not the degree of muscular activation that is deleterious. Thus, rumination and worry cause tension through the continuous or perseverative cognitive representation of near equivalent or incommensurate past or future choices. In addition, in this modern age, perseverative decision making between present choices or distraction is much more common, often continuous and inescapable, and results in the persistent activation of the musculature. Specifically, we consciously populate our environment with continuous distractive choices from email to the web, but continue to misattribute the resulting tension to the content rather than *context* of our choices.

That is, by emphasizing what choices we make rather than how our choices are related to each other, the origin of muscular tension derives from the wrong cause and engenders the wrong 'cure'. Thus, choice becomes incidental to tension as the latter is attributed to the level of activity rather than the choices engendered *by* that activity. The remedy for this error entails ultimately a redefinition of the very concept of stress itself.

The Meaning of Stress

"If you wish to converse with me, define your terms" (Voltaire).

In his class, the psychologist F. J. McGuigan[60] would induce relaxation in his students through the technique of progressive relaxation. He would then drop a book to demonstrate how the startle reflex and associated arousal is inhibited or impossible without the presence of muscular tension, a finding originally made by Sherrington[61] and explained neurologically by Gellhorn.[62] This underscored the physiological fact that tension is primarily not the result of arousal, but its cause. If the independent measure of choice is added to the equation, the theoretical principle follows that *tension is the body's specific response to near equivalent alternative choices*. Because it indirectly controls and is controlled by the prospect of the occurrence or nonoccurrence of future events or reinforcers, tension indirectly acts on the environment or is an operant behavior. However, although tension and accompanying sympathetic arousal may be characterized as stress, it cannot be formally defined as stress. This is because the latter's terms are not precisely defined.

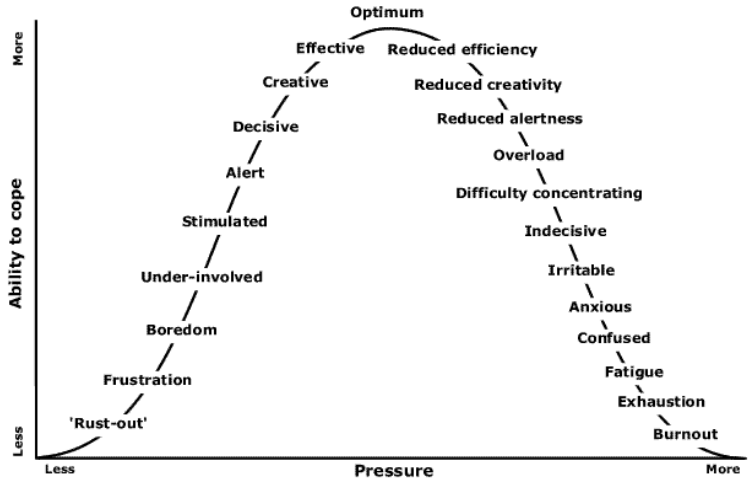
An operant definition of tension differs from Selye's classic definition of stress as "the body's nonspecific response to a

demand placed on it."[63] Yet these two principles are incompatible not because of their predictions but because of their meaning or *semantics*. That is, Selye's principle is not a scientific hypothesis because its terms are not clearly defined.

Ultimately, tension is initiated by the perception of means end response contingencies or expectancies due to the perseveration or dwelling on irreconcilable choices between past (rumination), present (distraction) or future (worry) events. Tension causes pain, which in turn intrinsically denotes the avoidance behaviors that will remove the tension that causes it. This is particularly important in the analysis of stress, since the common representation of stress implies that stress is a 'reaction' to demand events that bypass appraisal or cause and effect. However, whether tension and arousal are stress or represent a kind of stress is immaterial to the pragmatic implications of an operant analysis of tension. Specifically, if the metaphor of 'choice' replaces the metaphor of 'demand' as the primary descriptor of the origin of tension, then how choices are arranged may provide a much more precise and uniform description of the operational measures that will permit us to predict and control the daily tensions that beset us. Nonetheless, this argument is won not by the simplicity and precision of a learning-based explanation, but through the power of procedure to effect behavioral change. That of course is the mandate and justification of psychology.

Life in the Abstract

If you want to navigate your world, it is helpful to start with four dimensions rather than two. Three physical dimensions plus the dimension of time are enough to plot when and where you are, but to predict where you are going; the basic motivational dimensions are just as simple. You start with goals that have a future or predicted utility, correct from moment to moment your estimate of your progress and that of the goal itself, and correct your estimate of the feasible contrasting behavior and goals that you could have chosen. In other words, from moment to moment you are making choices both consciously and non-consciously between different exclusive alternatives under different degrees of uncertainty. These variables can be enfolded into an even simpler model of behavior that reduces it all to a function of demand. So why do you behave? In the most rudimentary sense, it is because it is demanded. Naturally, when faced with demand we overtly and covertly respond in different ways. If demand is low, then we are bored and under involved, but ramping it up a bit and soon you become interested, involved, and alert. Increase it even further, and your arousal and involvement peaks, and its emotionally downhill from there as you become anxious, confused, and exhausted. All of this can be mapped to a nice smooth bell curve, where you can map how you behave and how you feel to the simple correlation between what you can do and what you must do. This bell curve, codified as the Yerkes-Dodson law, handily calculates your likely emotional state if you knew beforehand the level of demand or challenge.



The Yerkes Dodson Performance Curve, Version 1

The problem though is that the Yerkes-Dodson law[64] has little if anything to do with Yerkes or Dodson and may be rephrased to demonstrate correlations for many different psychological states. As the psychologist Karl Teigen put it: *In its original form as published in 1908, the law was intended to describe the relation between stimulus strength and habit-formation for tasks varying in discrimination difficultness. But later generations of investigations and textbook authors have rendered it variously as the effects of punishment, reward, motivation, drive, arousal, anxiety, tension or stress upon learning, performance, problem-solving, coping or memory; while the task variable has been commonly referred to as difficulty, complexity or novelty, when it is not omitted altogether. These changes are seldom explicitly discussed and are often misattributed to Yerkes and Dodson themselves. The various reformulations are seen as reflecting conceptual changes and current developments in the areas of learning, motivation and emotion, and it is argued that the plasticity of the law also reflects the vagueness of basic psychological concepts in these areas.*[65]

In other words, the Yerkes-Dodson law approaches meaninglessness because it is merely a taxonomy for a lot of meanings that if patched together can result in nice smooth bell curves. Nonetheless, relationships or correlations between demand and arousal are useful, and are the stuff of the daily heuristics or rules of thumb that we use to guide our lives. However, correlations themselves may not suggest explanations, and can indeed impede or obscure them. Many of the relationships we perceive are obviously spurious because they have no conceivable explanation, and even if 'explained' by inferred forces or processes, repeat observations would dissuade us of their reliability. For example, rising hemlines may correlate with rising stock prices for a period of months, and may be explained by the conjecture that stock brokers are emotionally perked up at the sight of a more revealing female dress, but observations over the long-term view dispel them. On the other hand, other relationships not only provide strong and consistent correlations, but allow us to quickly determine explanations. For example, a day of continuous rainfall correlates with flooding, but because we know the simple metaphors of hydraulics, we can easily move from correlation to explanation by understanding how collecting rain water causes floods. Correlations are still strong when you take a few steps back and enfold a primary cause or causes into a more encompassing taxonomy or classification that may at turns reflect meanings that are clear or obscure. For example, you can say that bad weather causes flooding, but 'bad weather' suggests the causes of flooding, namely excessive rainfall. In this case, the explanation for bad weather is preserved. However, the taxonomy of demand or for arousal does not suggest its components, and in fact obscures them. That is, the independent measure of

demand and the dependent measure of arousal signify disparate processes (e.g., anxiety, interest, and challenge) that denote no clearly defined constituent parts; hence the meaning or semantics of demand and arousal are vague or obscure. Of course, it can be helpful to be vague. It's simple, gets attention, makes a model that has some face validity, and it serves you well as a rule of thumb unless you want to make some specific prediction. That's when the model becomes inconsistent and fails, and it becomes incumbent to define your terms.

A Law for all Seasons

In psychology, nothing is more impressive than a bell curve. Bell curves tell you where you stand academically, socially, and psychologically. They are a swell way of graphically making an argument that hedges its bets. Thus, you can be anywhere on the curve, it just depends. Bell curves also have a faux mathematical rigor about them. Like a physical law, you change one variable and the other one changes in a proportional way. One such behavioral algorithm is the Yerkes-Dodson curve, which is mere metaphor really, as we commonly invoke the Yerkes-Dodson curve to support the hoary cliché in psychology that demand (i.e., stress) is good for you up to a point when things start going rapidly downhill (hence the bell curve).

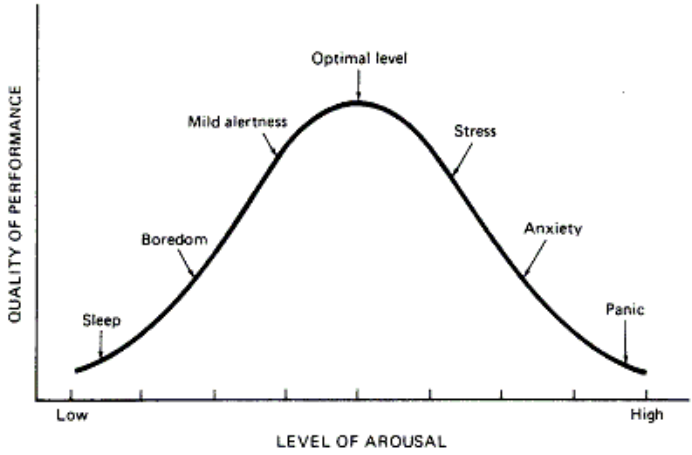
The original Yerkes and Dodson published their hypothesis way back in the year 1908 and has little to do with the little graph you see below, which in turn doesn't have a lot of empirical support in psychology anyways, but I digress. Basically, the Yerkes Dodson curve plots performance against physical arousal, which presumably represents real discrete events that can be plotted across the X and Y axes. Thus, given an X amount of performance,

you can reliably infer a Y amount of arousal, and vice versa. This is all well and good if performance and arousal are consistently defined things. The problem is, for arousal at least, it's not. What is arousal? Indeed, there are many kinds: sexual, emotional, physical. Thus, a fellow can be aroused while peeping into the girls' locker room, and aroused in a different way upon being discovered, and aroused more differently yet as he hightails it away.

Moreover, different states of arousal have different relationships to performance, and can occur separately or at the same time. Attentive alertness, as a form of arousal, increases performance as arousal increases. On the other hand, tension and attendant autonomic arousal, or anxiety, always decreases performance. Separate them both and the Yerkes-Dodson curve disappears, but combine them and out it pops. For example, a person who is highly and pleasurably aroused while climbing a mountain or creating art doesn't suffer in performance as his arousal increases but gains in performance. On the other hand, a person who is frustrated while performing a task progressively loses his ability to perform well as anxiety increases. Nonetheless, as demand increases and decreases, these two very different types of arousal can occur simultaneously and produce a performance curve very similar to the Yerkes-Dodson model.

As an aroused state, attentive alertness scales with the novelty or surprise of moment-to-moment behavior. As a function of the release of the neurochemical dopamine, touch and go events that entail continuous positive surprises (e.g. rock climbing, gambling, creative behavior) positively correlate with aroused alertness, which not only feels good but helps you think better. Thus, the bigger the positive surprise, the more alert you become, and the better your performance becomes. If, however, surprises start to trend from good to bad, alertness decreases as we become progressively more depressed, but tension and associated

autonomic arousal (i.e. anxiety) increases. That is, as news moves from good to bad, arousal doesn't increase, it just changes to an entirely new form! The problem though is that positive surprises always come at the risk that things will take a decided turn for the worse, as the rock climber get stuck in a snow storm and the creative artist hits a writer's block. Thus, the cost of higher good feelings is the chance you take that a turn of fortune will turn those good feelings bad. Generally, as demand increases risk increases, and at first we can handle it and be pleasantly surprised by and are motivated by the continuous moment to moment surprise of our success. But as demand ratchets up we are more likely to experience failure, and another type of arousal, that of anxiety. Hence as demand goes up, so do performance and arousal until performance reaches a crest and arousal begins to change not in amplitude but begins changing in kind. So, the Yerkes Dodson bell curve survives, it is rather the idea that arousal does not change in kind across the level of performance that falls away.



Yerkes Dodson Performance Curve, Version 2 of 200

The lesson we learn from all this is that the highest motivation or performance stands at the cusp of failure, as we are rarely motivated by the sure and thus boring thing. Unfortunately, what psychologists take from the Yerkes-Dodson curve is the wrong lesson entirely, that arousal is a monolithic and indivisible thing that does not categorically change as demand increases. In other words, the lesson that no pain equals no gain is wrong. Rather, if you have pain you will likely have no gain. For folks that are a bit wary of the school of hard knocks, this is perhaps a lesson one can get a bit excited about.

To begin defining your terms, you must first define what you are measuring, and we will start with the dependent measure of arousal. We will notice first that there are multiple ways you can be aroused. Indeed, the Yerkes-Dodson performance curve is dotted with emotional transformations from boredom and interest to anxiety and bliss. These demonstrate that for arousal, there are many distinctive emotional correlates, and the problem seems complex and near intractable. After all, our emotions are incredibly diverse, or least that is what the innumerable metaphors for emotion would hold. Yet observation provides a different perspective that our emotions are not as idiosyncratic as they seem, and represent mainly the permutations of simple and elementary processes. For the processes that underlie arousal, namely the neurological and autonomic (i.e., neuro-muscular) response to information, our argument so far has followed along these lines. However, this position is not original, and was proposed more than a hundred years ago.

Wundt Was Wight!

(with apologies to Elmer Fudd)

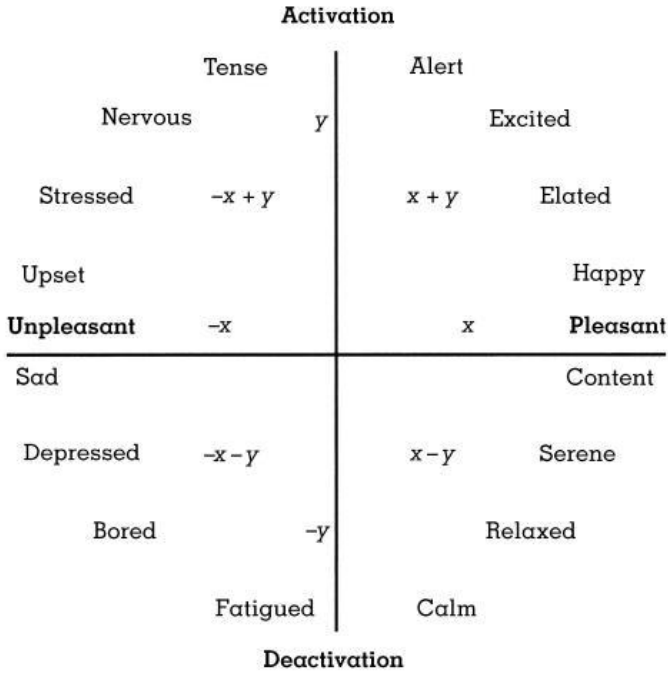
In 1897, Wilhelm Wundt, the founding father of experimental psychology, proposed a dimensional scheme for affect. According to Wundt: "In this manifold of feelings… it is nevertheless possible to distinguish certain different chief directions, including certain affective opposites of predominant character." Wundt identified three bipolar dimensions: (i) pleasurable versus un-pleasurable, (ii) arousing versus subduing, and (iii) strain versus relaxation. From our analysis so far, these affective states may be mapped to the activity of opioid (pleasure), dopaminergic (arousal), and neuro-muscular (strain) systems, which may in turn be mapped to information as reflected by act-outcome contingencies or expectancies. Wundt proposed that these dimensions laid the foundation for emotional experience. Despite subsequent research inspired by many of Wundt's ideas (most notably in the field of psychophysics), his theory of affect had lain dormant for a century. True to his physiological training (but in contrast to his competitor and contemporary William James), Wundt assumed that affect originated in the brain as well as the peripheral body. Thus, Wundt implicitly rued the lack of technology that might allow him to track neural activity and correlate it with affect when he stated: "Which central regions are thus affected we do not know. But…the physiological substrata for all the elements of our psychological experience are probably to be found in the cerebral cortex…"[66]

Wundt's analysis was prescient, and foreshadows later findings that distinguish between the neural opioid systems

that modulate physical pleasure or 'liking', the dopaminergic systems that modulate attentive arousal or 'wanting'[67], and those that modulate autonomic arousal and opioid activity as respectively elicited by muscular tension and relaxation. Emotions in other words could be spun from first principles, like the motions of a ball from an algebraic cipher, or the colors of an artist's pallet from an admixture of three primary colors. Knowing how colors are derived from the primary colors of red, green, and blue give you the color wheel, where every shade and hue can be derived from these basic colors. Similarly, Wundt's observation found illustration in 'circumplex' descriptions of emotion, wherein diverse emotional states are derived from the distinctive subjective aspect of experience, or its 'qualia'. As a modern-day example of this the Feldman Barrett and Russell emotional circumplex maps emotional states such as elation, tension, boredom etc. to the intersection of concurrent primary arousal states that move on the subjective axes from unpleasant to pleasant and activation to deactivation.[68]

The problem with this emotional circumplex, as with the color wheel, is that they provide no explanation for arousal or color. So just as mapping color requires explaining color as a function of aspects of different wavelengths of light, so too does a description of primary arousal states require them to be explained, or in other words, described not just subjectively, but objectively, and refer to actual neuro-biological systems. The Feldman Barrett and Russell model maps the subjective and not objective correlates of emotional experience and does not map out the informative characteristics of the 'demand' that elicits these responses. It is this independent measure of information, in addition to

the dependent measure of arousal that must be defined. Doing so can provide the bases for an explanatory model for the states of arousal processes that comprise emotions that we argue are based upon the mundane events that comprise daily experience.



[α] The letters x and y represent semantic components of core affect: x = pleasantness; y = activation (Feldman Barrett & Russell, 1998).

The cognitive representations of our day-to-day activities primarily involve decision making between multiple exclusive alternatives under varying degrees of uncertainty. These '*core appraisals*' represent moment to moment changes in the abstract (uncertainty) and functional properties (utility) of environmental contingencies that are consciously

or non-consciously perceived. Parallel somatic (tension and autonomic arousal), pleasurable (opioid release due to relaxation) and activating or 'energizing' (enhanced activity of dopamine neurons) events strongly correlate with specific permutations of these core appraisals, and are 'painful' or 'pleasurable' in nature. These changes alter the importance or salience of a momentary response option and as an additive function create emergent emotional states.

The cognitive variables of *contrast* and *discrepancy* can be observed to respectively correlate with tension and activation or alertness (as defined by its neurological correspondence with the increased activity of mid-brain dopamine systems).[69] In addition, the degree of contrast, discrepancy, and the predicted utility of moment to moment responding in combination correlate with the level of tension and activation, and in their various permutations correspond with subjective emotional states.

As defined:

Contrast reflects the comparative value of two alternative means-end expectancies or response contingencies.

Discrepancy reflects moment to moment unexpected variances in the immediate predicted outcome of a behavior.

Predicted Utility reflects the value of a moment to moment response as determined by long term hedonic (e.g. food, sex, etc.) or rational value (e.g. monetary reward).

Incentive Salience reflects the relative importance of moment to moment responding under a response contingency due to the utility of a response and to affective responses elicited by concurrently perceived discrepancy.

If there is a contrast between two alternative response contingencies of equal utility under certainty (i.e., little or no discrepancy in moment-to-moment act-outcome relationships), tension will occur, but the level of tension will vary with the predicted utility of a moment to moment response. Thus, tension will be less for low-utility choices than high. As these contingencies diverge in value, we make rational decisions to choose one of the alternatives and progressively less tension will occur. Thus, the choice between two conflicting low value alternatives (e.g. what dessert to order in a restaurant) will result in lower tension than a choice between two conflicting high value alternatives (e.g. what medical procedure to choose to treat a life-threatening condition). In addition, less tension will occur when more information is available that leads to one choice becoming more logically compelling.

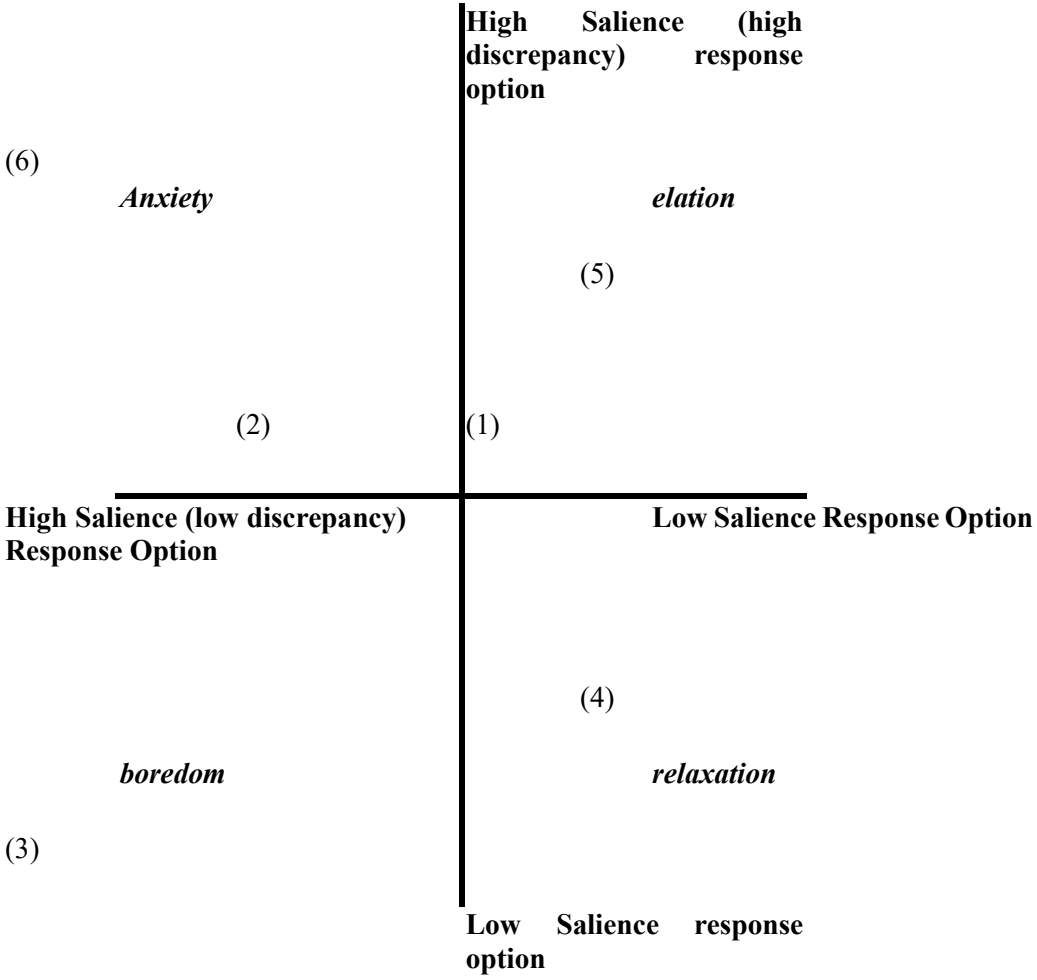
The increase in dopaminergic activity due to moment-to-moment discrepancy adds another variable that increases not only the incentive salience of moment to moment responding, but also alertness (i.e., sensorimotor activation) and affective tone (i.e., a good or bad feeling). Dopamine induced activation also scales monotonically with the qualitative or informative aspects of discrepancy.[70] For example, tasks that entail moment to moment positive discrepancy (e.g. creative behavior, sporting activities, surfing the web, etc.) under circumstances wherein the incentive salience of alternative responses is relatively low will correlate with feelings of alertness/activation or attentive arousal *and* low or non-existent tension (or low degree of discomfort or a pleasant feeling). Tasks that entail a moment-to-moment positive discrepancy wherein the incentive salience of alternative responses is relatively high will correlate with feelings of arousal *and* high and/or

constant tension (or high discomfort or pain). These feelings will also increase as the utility of a response increases, or in other words, we become more alert as the 'stakes' increase, and less alert as they decrease. As the incentive salience of alternative responses increases to match the increasing salience of a primary response, the level of tension and corresponding autonomic activation will increase as well and result in a state of anxiety. Correspondingly, if the salience of a response increases as the salience of an alternative response decreases, tension will fall and activation will increase, resulting in a state of elation or ecstasy due to the combined activity of opioid (due to relaxation) and dopamine systems (due to act-outcome discrepancy).

For example, moment to moment positive discrepancy in high value sporting or creative events (e.g., a 'flow' response)[71] is marked by a feeling of energy, or 'elation' and corresponding low tension induced autonomic arousal or 'coolness under pressure' and accompanying pleasure when the salience of contrasting response options is low. However, as the salience of these options increase in value, tension becomes progressively more likely to occur both in persistence and intensity until activation and tension are continual and high, or in other words, we become anxious or stressed. In addition, as the salience of both primary and alternative response options *decreases*, activation decreases along with muscular tension, and we feel pleasurably relaxed. Finally, a predictable response option that is highly salient due primarily to its high predicted utility and contrasts with low value alternatives will often be reported as a boring or depressing experience if activation is not high enough (as embodied by the under stimulation of the dopamine system) to energize one to "want" to perform an

action that is ultimately valuable (e.g. working under a piece work schedule of reward such as in an assembly line).

To illustrate how affect dynamically changes over time as a function of information and discrepancy, consider the hypothetical example of a worker in a home office (Figure 1). Waking up in the morning and accessing email, the daily news, social network postings, etc. correlates with a feeling of pleasantness (1). However, as the morning progresses, this behavior begins to contrast with other equally salient response options (her work), correlating with sustained tension (2). If these 'distractive' choices continue, the musculature will soon fatigue and be replaced by other muscular groups, creating muscular pain and a feeling of exhaustion at the end of the day. If the worker begins to cold call clients with little or no response, then she will quickly become bored (3), and may also become depressed when she recognizes that her lack of activation forestalls her obtaining her long-term goals. Taking a time out from her duties by sitting quietly and barring distractive thoughts will result in relaxation (4). If she is completing a project to meet a deadline "just in time", then she will feel pleasantly alert (5). If she falls behind her task and/or is distracted by other pressing matters and thus perceives alternative irreconcilable choices or dilemmas, she will feel anxious (6).



Behavioral Circumplex Model of Emotion

Emotion as a Conceptual Act

This model assumes that emotional states are additive functions of separate somatic and neurological events (tension, opioid and dopamine activity) that are highly correlated with different informative or cognitive causes (contrast, discrepancy) that are abstract properties of response contingencies. The model conforms to the Conceptual Act Model of emotion that suggests that "*these emotions (often called 'basic emotions') are not biologically hardwired, but instead, are phenomena that emerge in consciousness 'in the moment," from two more fundamental entities: core affect and categorization*" (Wikipedia). Per this model, "*core affect is a pre-conceptual primitive process, a neuro-physiological state, accessible to consciousness as a simple non-reflective feeling: feeling good or bad, feeling lethargic or energized*."[72] "*Core affect is characterized as the constant stream of transient alterations in an organism's neuro-physiological state that represents its immediate relationship to the flow of changing events*…." The Conceptual Act Model allows for the existence of processes that are biologically given but whose content must be learned. It considers affect as a core feature of all aspects of human psychology. Third, it relies on a situated conceptualization view of conceptual knowledge. The conceptual knowledge that is called forth to categorize affect is tailored to the immediate situation, acquired from prior experience, and supported by language."[73] Ultimately, the difference between both models is a matter not of theory, but of semantics. Namely, with the Conceptual Act model, core affect has no clear specific or objective referent. In other words, the neuro-physiological concomitants of pain/pleasure, lethargy/energy and the elemental informative or cognitive events that correlate with these processes are not clearly defined nor are they clearly

mapped to information as denoted by the flow of changing events. As a solution to this problem, high and pronounced tension and autonomic arousal are posited to represent an unpleasant state, and profound relaxation represents a pleasant state. Similarly, the high and persistent activation of dopamine systems is related to high activation and alertness, and conversely low activation of dopamine systems is related to low activation and low alertness or boredom. The graphical representation of this model parallels 'circumplex' models of affect[74] that posit that emotions are additive functions of separate affective processes that are mediated by separate causes (Figure 2).
By establishing a clear meaning for the components of affect through the clarification of their abstract cognitive or informative antecedents, neuro-physiological content, and informative consequences, the circumplex model is transformed from a descriptive account of emotion to a *predictive* account that allows behavior and affect to be clearly defined and reliably mapped to simple patterns of information that in turn denotes act-outcomes relationships or behavioral contingencies. In other words, emotions are *behavioral*, and can be described and manipulated through the simple arrangement of response contingencies.

Affect and Information

In affective neuroscience, affect is elicited by interoceptive stimuli generated by normal allostatic processes (the wear and tear of life, from hunger and thirst to fighting disease and achieving wellness), impinging exteroceptive stimuli (anticipating or experiencing food, sexual, or other events), or consciously or non-consciously perceived information that corresponds to act-outcome expectancies or contingencies (the day-to-day vicissitudes of life).

Expectancies also indirectly elicit affect through their activation of covert neuro-muscular behavior which guide decision making and are intrinsically painful or pleasurable.

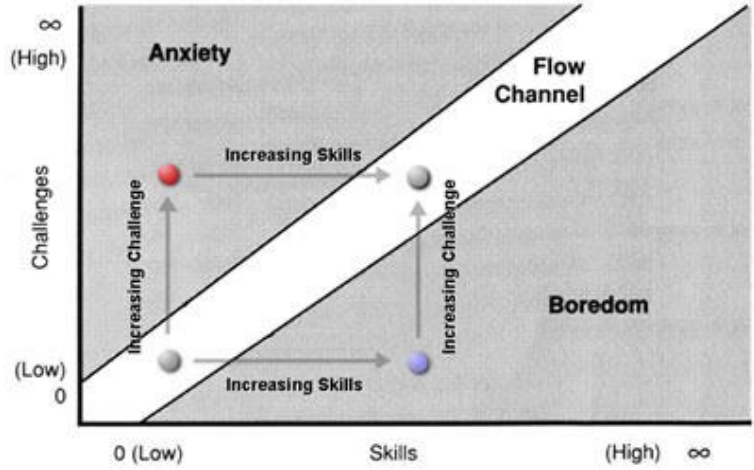
For the concept of emotion and the affective events from which emotions are derived, the predominant perspective in psychology maps the cognitive source of emotion to *normative* properties of information, or the *contents* of experience. Here a different view is argued, that emotion is elicited by *abstract* properties of information (contrast, act/outcome discrepancy, incentive salience) that in turn can be schematically depicted through a circumplex model that plots affect to correlations of rudimentary informative events.

Ultimately, this analysis validates the psychologist B.F. Skinner's original conceptualization of a radical behaviorism that mapped behavior to abstract properties of information as denoted by schedules of reinforcement or act-outcome contingencies. Whereas in his time Skinner could only map overt responses to contingencies, the resolving power of our present-day observational tools allow us to map the same contingencies to the activity of affective systems in the brain (opioid and dopamine systems) as well as covert neuro-muscular activity and provides contingency or behavior analysis with much greater predictive power and scope. Whether behavior analysts will avail themselves of this new perspective remains for the future to decide.

The Flow Experience

The Yerkes-Dodson model of arousal was of course not the only model that attempted to map emotion to demand. Consider an alternative yet similar model for yet another supposedly unique emotional state, the flow experience. Flow was coined by the psychologist Mihalyi Csikszentmihalyi[75] to describe the unique emotional state that parallels one's complete 'immersion' in a task. As described by the psychologist Daniel Goleman, "Flow is completely focused motivation. It is a single-minded immersion and represents perhaps the ultimate in harnessing the emotions in the service of performing and learning. In flow, the emotions are not just contained and channeled, but are energized and aligned with the task at hand. To be caught in the ennui of depression or the agitation of anxiety is to be barred from flow. The hallmark of flow is a feeling of spontaneous joy, even rapture, while performing a task."[76]

These descriptions are of course metaphorical representations of the experience of flow, and describe what flow is like rather than what it is. Because these 'dependent' measures of flow have no empirical referent (What is the neurological equivalent of spontaneous joy for instance?), one is left with the independent or antecedent variables of demand and skill that elicit flow, which thankfully *can* be empirically defined. What is unique about these variables is that they not only map to flow experiences, but also other emotional experiences such as anxiety and boredom. Thus, Csikszentmihalyi's model does not just represent flow, but a wide range of emotional experiences. The question is, although emotion maps to demand and skill, can demand or skill be manipulated *in the moment* to elicit flow, or for that matter, any other emotion?



The Flow Channel

On the surface, the graphical representation of the flow channel is simple to understand. Just plot your moment-to-moment challenge against your moment-to-moment skill, and voila, you can predict what your emotions are going to be. For any task, the problem is that although demand moves up or down dependent upon the exigencies of the moment, skill should be relatively stable during or *within* the performance, and only change, and for the most part gradually *between* performances. Thus, one may accomplish a task that from moment to moment varies in demand, but the skills brought to that task are the same *regardless* of demand. What this means is that for any one-performance set, skill is not a variable, but a constant. That is, one cannot adjust skill against demand during performance because skill can only change negligibly *during* performance, or in other words does not move. Thus, for performance that requires any skill set, the only variable that can be

manipulated *is* demand.[20] For moment-to-moment behavior the adjustable variable that elicits flow is demand and demand alone. But that leaves us with figuring out what demand exactly is.

A demand may be defined as simple response-outcome contingency. Thus, if you do X, Y will occur or not occur. It is thus inferred that demand entails a fully predictable means-end relationship or expectancy. But the inference that the act-outcome expectancy is always fully predictable is not true. Although a response-outcome is fully predictable when skill overmatches demand, as demand rises to match and surpass skill, uncertainty in the prediction of a performance outcome also rises. At first, the uncertainty is positive, and reaches its highest level when a skill matches the level of demand. This represents a 'touch and go' experience wherein every move most likely will result in a positive outcome in a calm or non-stressed state. It is here that many individuals report euphoric flow like states. Passing that, the moment-to-moment uncertainty of a bad outcome increases, along with a corresponding rise in tension and anxiety.

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[20] **Although in general skill or ability remains constant within performances, occasionally skill can be perceived to vary within a performance due to physiological or cognitive variables that are independent of demand. This does not change however the fact that one can only counter this by adjusting demand, as skill or ability is NOT a property that can be manipulated in the moment. For example, a rock climber may re-consider the level of her skill because of her moment-to-moment physical health or reduced confidence in her ability due to a near fall. In these occasions the climber would adjust demand by taking more time before each move or moving to a less difficult ledge**.

Momentary positive uncertainty as a logical function of the moment-to-moment variance occurring when demand matches skill does not translate into a predictor for flow, and is ignored in Csikszentmihalyi's model because uncertainty by implication *does not elicit affect*. Rather, affect is imputed to metaphorical concepts of immersion, involvement, and focused attention that are not grounded to any specific neurological processes. However, the fact that act-outcome discrepancy in relaxed states *alone* has been correlated with specific neuro-chemical changes in the brain that map to euphoric, involved, timeless[77], or immersive states, namely the co-activation of dopamine and opioid systems due to continuous positive act/outcome discrepancy and relaxation, narrows the cause of flow to abstract elements of perception rather than metaphorical aspects of performance. These abstract perceptual elements denote information and can easily be defined and be reliably mapped to behavior.

A final perceptual aspect of demand that correlates with the elicitation of dopamine is the importance of the result or goal of behavior. Specifically, dopaminergic systems are activated by the in tandem perception of discrepancy and the predicted utility or value of result of a response contingency. The flow model maps behavior to demand and skill, but not only is skill fixed, so is the importance of the goal state that predicates demand. However, the relative importance of the goal state correlates with the intensity of affect. For example, representing a task that matches his skills, a rock climber calmly ascending a difficult cliff would be highly aroused if the moment-to-moment result was high, namely avoiding a fatal fall, but would be far less so if he was attached to a tether, and would suffer only an injury to his pride is he were to slip. Finally, the flow experience

correlates also with a state of relaxation and the concomitant activation of opioid systems along with a dopamine induced arousal state that together impart a feeling of euphoria, which would also be predicted as choices in flow are singular and clear and therefore avoid perseverative cognition. In addition, the joint activation of opioid (pleasure) and dopamine (arousal) will result in their co-activation or stimulation, resulting in a much higher affective tone that if either was activated separately. It is the sense of relaxation induced pleasure and a feeling of attentive arousal as well as their interaction that constitutes the subjectively felt flow experience.

The flow experience, like the Yerkes-Dodson model that predates it, is not an explanatory model because it does not derive from a neurologically grounded explanation. Secondly, it is not even a very good *descriptive* model because it imputes a moment-to-moment variability in skill within a performance set that is not characteristic of *any* single performance, and because it ignores other correlations between moment to moment act-outcome discrepancy (or risk), resting states, and affect that are well demonstrated in neurological explanations of incentive motivation. For example, dopaminergic activity may be elicited because of the positive uncertainty of the results of behavior that may occur from moment to moment (the touch and go quality of demand/skill equivalence) or perceived virtually in the future (the perception of branching uncertain and positive outcomes, or positive meaning). Dopamine is enhanced further through its synergistic relationship with relaxation induced opioid activity. Thus, a rock climber can achieve high positive affect through the demand/skill match as he riskily but calmly climbs a mountain, or he can be equally affected by

taking a safe, straight and narrow course, motivated by the arousing likelihood of fame and fortune laying at the end of the trail.

Ultimately, the flow experience purports to explain a key facet of incentive motivation through an inductive approach that misrepresents the dependent (skill) and ignores the independent variables (discrepancy) that truly map to the affective and motivational experience that is flow. In other words, as a creature of metaphor flow is good literature, but not good science because it eschews the explanatory essence *of* science.

Nonetheless, as literature can speak of hidden and unrevealed truths, the flow experience emerges from affective neuroscience, with the entailments regarding meaning and human virtue and happiness conforming with Csikszentmihalyi's own research and prescriptions, which is no small feat indeed.

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